UNIV. OF

SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS

SPEEDING UP THE ICE HARVEST WITH THE GASOLINE-DRIVEN SAW—[See Page 167]

Vol. CXXII. No. 7
February 14, 1920

Published Weekly by
Scientific American Publishing Co.
Munn & Co., New York, N. Y.

Price 10 Cents
$5.00 a year

Entered as second class matter June 18, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879

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SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXXII. NUMBER 7 | NEW YORK, FEBRUARY 14, 1920 | 10 CENTS A COPY $5.00 A YEAR

Dredges of Other Days

By Rudolph L. Zimpel

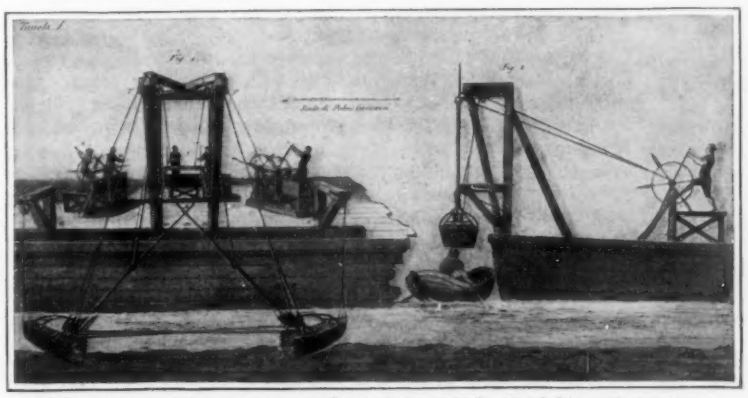
DREDGING of rivers and harbors is an industry probably as old as shipping. The vessels navigated by the ancient Greeks and Romans were of shallow draft, and recourse to increasing the available depths of waters in harbors by artificial means was no doubt unnecessary. It is reasonable to suppose, however, that a certain amount of dredging was done to provide docking facilities at wharves or landings. The earliest known dredging apparatus consisted of long handled dippers in the hands of men.

A dredging machine was patented and used at Venice in 1536 by one Anthony Kolb, a native of Germany. It was of the spoon type, and no doubt similar to the machine used in Holland in 1591, which consisted of two pontoons lashed together, with two spoons working in opposite directions and operated by man power. Horse-power was applied to this type of machine in 1685 by Cornelius Meyer of Holland. An entirely new type of machine was evolved in 1708 in the shape of a wheel dredge having six buckets attached to the circumference of a wheel mounted between two scows.

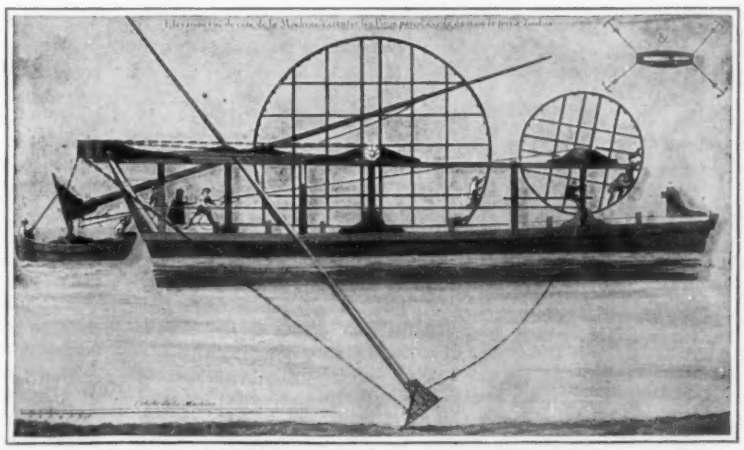
The spoon dredge was not improved upon apparently for about half a century, when a dredge was built and operated in the harbor of Toulon, France. This machine is carefully described by Colonel Belidor in his "Architecture Hydraulique" published in Paris in 1737, from which book the accompanying illustrations of it are taken. It consisted of a scow equipped with a dipper on each side, the motive power being two walking wheels. The walking wheels were very much like squirrel cages, being operated by men climbing the inside of the rim and by their weight causing the wheel to revolve. The wheels were of different diameters. The larger one, providing the greater leverage, drew the dipper into and through the material to be dredged, and the smaller one drew it back into position again for another dig. The dippers were attached to long poles which were pivoted to the superstructure of the scow by means of rope fastenings, thereby regulating the depth of the work, and also preventing the dippers from sliding over the surface of the material, if it happened to be hard. The dippers were dragged forward by means of a chain attached to them, and extending over a pulley on the forward superstructure to the axle of the larger walking wheel acting as a drum, upon which the chain was bound. The axle of the smaller wheel was similarly used as a drum to draw the dippers back after they had been emptied into a small boat. A remarkable feature of this machine is the efficiency obtained by the two dippers operating at once, but in reverse order. While one dipper was dragged forward, the other was going back into position, both wheels being under continual load.

In the operation of these early machines, the water current was largely depended upon to carry away the loosened material at the bottom, more being removed in that manner probably, than that which was actually raised by the dredges.

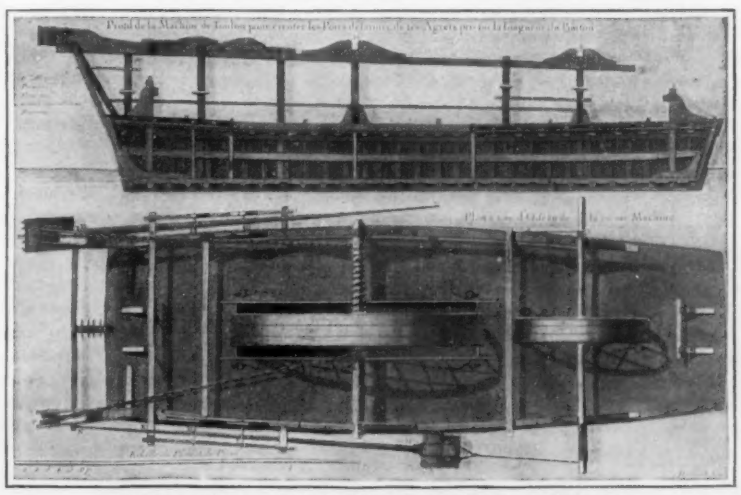
The first example of the ladder type of machine having iron buckets attached to an endless chain, was used at Orleans in 1750. This dredge seems to have been the forerunner of the modern steam ladder-dredge, which type has always been largely used in England and on the Continent. Up to this time only two types of dredging machines had been built; the dipper dredge and the ladder machine, not counting the wheel dredge, which does not appear to have been a success.



The ancestor of the orange-peel bucket, as seen in an eighteenth-century Italian dredge



A French dredge of the 1700's, which derived its motive power from "walking wheels" that worked like a squirrel cage



Profile and plan of the Belidor dredge illustrated above

A radical departure was used at Genoa in 1773, resembling in a measure the modern clamshell bucket dredge. The illustration of it is taken from a book by Domenico Gerra, its inventor, entitled "Descrizione Practica e Teorica D'un Modello di Macchina Detto il Compasso." This machine was operated over the side of a scow by three hand winches, and consisted of two sections of a bucket which were attached to two poles like the legs of a compass, and from which it was named "il Compasso." The sections of the bucket were drawn together through the mud in a horizontal plane by two winches, after which all three were used to lift it out of the water to be emptied into a small boat. The device was brought back into position by releasing the tension on the winches and allowing the bucket sections to swing from the davits.

As the 18th century was drawing to a close, great strides were being made in the mechanical world. The steam engine was coming into gradual use for various purposes, and in 1797, the firm of Boulton & Watt built a steam engine to be used on a dredger in England. This machine, which was the first practical steam dredge, was used in the harbor of Sunderland. It is to be regretted that descriptive drawings of this machine do not seem to be extant. The available description of it leaves much to be conjectured. It appears that the machine operated four dippers with a capacity of one ton each, and that they were raised at the rate of ten feet per minute. The dippers were made in the form of truncated cones of leather, with the large end open, and having a spade bit. The engine was of four horse-power, having a 12½-inch cylinder, 3-foot stroke and making 30 revolutions per minute. The weight of the engine and other machinery was 23 tons, the whole being mounted on a flat boat 60 feet long, 20 feet wide, and 6 feet deep, having a draft of 4 feet. I am of the opinion that the principle of this dredge was along the lines of Belidor, having two dippers on each side of the vessel.

This machine was discarded in 1811, and a steam ladder dredge used in its place in the same harbor, being the first steam dredge of this type. The efficiency of the steam ladder dredge seems to have asserted itself almost immediately, for in 1814, anonther one was used on the Caledonian Canal. The ladder frame on this dredge was 42 feet long, and had a set of 25 buckets, driven by a 6 horse-power engine. It appears that some difficulty was experienced in penetrating the hard clay encountered in the course of the work, and to overcome this, every alter-

(Continued on page 171)

SCIENTIFIC AMERICAN

Published by Scientific American Publishing Co.
Founded 1845
New York, Saturday, February 14, 1920
Munn & Co., 233 Broadway, New York

Charles Allen Munn, President; Orson D. Munn, Treasurer
Allan C. Hoffman, Secretary; all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

A Simple Matter of Duty

AN attempt is being made to discredit Admiral Sims in the eyes of the public by representing him as having been guilty of a breach of confidence, when he read before the Senate Naval Committee the verbal instructions which had been given him as to his atttitude toward our principal naval ally in the war.

It would be impossible to make a more untrue and unjust accusation than this. In writing his letter to Secretary Daniels and in reading it before the Senate Committee at the command of its chairman, Senator Hale, Admiral Sims was following out the naval regulations and obeying the command of his superiors.

It is to be understood, in the first place, that the Admiral was acting in a dual capacity in Europe. He was sent to Europe in April, 1917, as American representative upon the Allied Naval Council, which was made up of the secretaries and chiefs of naval operations of the various allied navies. The Council met at least once a month and was in the closest touch with the conduct of the war so far as naval operations were concerned.

But in addition to this he bore the title "Commander of United States Naval Forces Operating in European Waters." Under him were such subordinate commands as those at Gibraltar, Bordeaux, Brest, Queenstown, the Mining Squadrons and the battleship division with the Grand Fleet. As "Commander in European Waters" his forces were theoretically part of the Atlantic fleet, and he was subordinate to Admiral Mayo. Actually, he was independent of any other naval commander, as shown by the fact that he communicated directly with our Navy Department. Later, in order to keep everybody informed, he furnished copies of his communications to his nominal head, the Commander-in-Chief of the United States Atlantic Fleet.

Now, that the Admiral was justified in sending the comments and suggestions which he did to the Secretary, and, indeed, that it was his duty to do so, is proved by Article 1534, subparagraph 4, United States Naval Regulation, 1913, which reads as follows:

"Nothing in this article shall be construed as prohibiting officers from forwarding to the Department, through official channels, well-considered comment and suggestions with a view to promoting the efficiency of the service and the public interests; on the contrary, such suggestions are invited, but they should be in regard to things or methods and not a criticism of persons, and should in all cases be accompanied by a well-digested plan for improvement. Such suggestions, if approved by the Department, will be entered on the officer's record and he will be duly notified to that effect."

It is plain as a pikestaff, after reading the above, that in sending a confidential communication directly to the Secretary, the Admiral cannot be accused of divulging confidential instructions, for the Secretary is, of course, responsible for and familiar with any confidential matter of this kind. In fact, the Admiral seems to have taken special pains to safeguard the sanctity of the letter, for, we understand that he placed no copies of it in the War College files and that the one copy which was made was retained in the Admiral's own confidential file which he took with him to Washington. A study of the newspaper files will show that the Secretary of the Navy himself announced the existence of the letter of January 7th, 1920, to representatives of the press; the fact of its existence was thus made public.

Now, when Admiral Sims was under examination by the Senate Naval Committee, the chairman of this committee, Senator Hale, called for the production of the letter. Admiral Sims might have protected himself and escaped the unjust comment which is now being aimed against him, had he sidestepped the issue and suggested to the chairman that the proper person to produce the letter was Secretary Daniels himself. But the life-long training of a naval officer teaches him to obey orders which emanate from the proper authority, and in this case, the chairman of the committee was vested with this authority. Acting under this authority, he called for a document, and the Admiral, true to the traditions and training of the United States Navy, obeyed and produced the letter, after making as strong a protest as he thought permissible.

Now, Admiral Sims' charge not only that our Navy was unprepared but that practically nothing was done up to the moment of our entry into the war to make it ready, was borne out by a speech recently made by the Assistant Secretary of the Navy, in which he is said to have stated that he had risked penalties totalling 90 years of imprisonment in preparing the Navy for war. This statement has been qualified by the Assistant Secretary, we understand, to the extent that he has stated that he intended no criticism of any of his superiors and that the Navy was entirely prepared for peace, but not entirely prepared for war. It is common gossip in inner circles, and in outer circles for that matter, that a large share of the splendid work done by our Navy in the war was due, more than the general public has any idea of, to the fearless, far-sighted and quick action of the Assistant Secretary in backing up and pushing through the plans of technically competent officers serving in the various bureaus of the Navy Department. The chance to get this result came, we believe, during a short absence of Secretary Daniels.

Cause and Effect

IS the high cost of living (in part) the result of high wages, or are high wages the result of the high cost of living? Which is cause, and which effect? Is the inflation of currency the result of high prices, or is it the other way about? A man saves today, in order that he may enjoy the benefit tomorrow. Is tomorrow's benefit, then, the cause of today's action?

Sometimes a homely illustration points a truth more aptly than a long disquisition. There is the old picture of the driver of a donkey cart dangling a tuft of thistles before the nose of the proverbially recalcitrant animal. The donkey moves forward because he wants to catch up with the tantalizing morsel, and the thistle persistently evades his grasp because the donkey keeps moving. Is the motion of the thistle the cause of the donkey's willing progress, or vice versa?

The simple fact, of course, is, that the motion of the bait is both cause and effect of the donkey's motion. It is not always easy or even possible clearly to distinguish between these two links in a chain of events. We may think of the motion of the donkey as divided up into small instalments. When he first catches sight of the thistle, he moves forward a little. He strains on the harness, and in a moment his motion is transmitted to the cart, and thus to the thistle. So far the motion of the donkey is cause, the motion of the thistle effect. But the next instant conditions are reversed, the donkey feels impelled to move forward in order to follow the elusive thistle. And so the thing goes on, an alternation of mutual cause and effect. When we speak of the motion of the thistle we sum up in one term a series of steps which are alternately effect and cause of the motion of the donkey. The motion as a whole is thus both cause and effect, strange as this may seem at first.

So much for our illustration, trivial, perhaps, but offered without apology. For it points a practical lesson. The cost of living goes up a little, then wages go up to catch up with it. Then the process starts over again, and goes on in a vicious circle. It is like a cat chasing its tail. How long will this continue? Where will it lead? Let some wise man tell us, if he can. We offer no suggestion. We will only add the remark that the relation between the expansion of our credit instruments and the present high prices is probably of the same kind.

Those Martian Radio Signals

MARS is again in the public eye. For several weeks past there has been almost no end to the opinions of the leading scientists and radio experts of this and other countries regarding the mysterious wireless signals received by Marconi, the inventor of practical wireless telegraphy, at several of his stations. Marconi has stated publicly that the signals, because of their exceptionally long and fixed wave length, as well as their marked similarity to the Continental-Morse code, lead one to believe that they are perhaps generated from some point outside the earth, and if so, most likely Mars.

At this late date when so many dreams of yesterday have become stern realities, it would be foolhardy indeed to discredit Marconi's statement on the face of it; for, to be sure, there is no definite proof either way to show that he is right or wrong in his hypothesis. Examining the facts in the case, we learn that the signals are of an exceptionally long wave length—a wave length far in excess of those generally employed for long-distance work. Next, we learn that the wave length is practically constant, which would naturally lead one to believe that the signals are artificially generated. Then we are told that the signals are received with equal strength at stations spaced several thousand miles apart, which is a truly remarkable fact, since, so far, any signals generated with our most powerful transmitters rapidly lose strength the farther they have to travel. Finally, the signals are said to simulate the Continental-Morse code, which is that almost universally used in radio work.

Turning to the other side of the case, we find ready explanations for these facts which soon weaken the possibility of Martian signals. In the first place, we have absolutely no proof that there are inhabitants on Mars. Secondly, if there are Martians, would it not be rather a strange coincidence if they had worked out radio telegraphy and a code along the same lines as we have? And would it not be strange that they have succeeded in obtaining sufficient power and apparatus to transmit over the tremendous distance of 50,000,000 miles? Then there is this striking flaw in Marconi's suggestion, namely, that the signals have been received only at his stations. The Eiffel Tower station at Paris, some of our Navy stations, and other radio stations equipped to receive exceptionally long-wave signals report that they have not heard the signals to which Marconi refers, although they have searched for them.

That the signals are due to atmospheric disturbances or possibly sun spots seems a most plausible explanation, although there is the matter of constancy of wave length to weaken it. Generally, atmospheric and other natural disturbances have a wide wave length, a fact which causes them to interfere with radio communication, since they cannot be tuned out with ordinary circuits. But when it comes to the signals resembling the Continental-Morse code, this is nothing unusual. At times the natural disturbances occur at such intervals that one is apt to confound them with regular signals until it is discovered that they are meaningless.

All in all, this matter deserves careful study when a scientist of Mr. Marconi's standing takes it so seriously. With the facts so far in hand, most scientists and radio men lean toward the opinion that the signals are simply natural disturbances, or possibly some new radio station of extreme power in some far corner of the earth. Perhaps it may be the Japanese, who are known to be developing new radio systems with some success. Again it may be the Russian Bolsheviki, who have turned to radio as a convenient means of propagating their cause at home and abroad. But we must all await further and more definite information before passing judgment one way or the other in this interesting controversy.

Electricity

Electrification of Seeds.—There appears to be much interest in the electrification of seeds and the application of electricity to growing plants. A recent account of work along these lines tells of a new method of aiding plant growth. The seeds, 10 or 20 sacks, are placed in tanks provided with iron electrodes at both ends; the electrolyte is a solution of sodium nitrate or some other fertilizer. Particularly with cereals—wheat, barley and oats—the yields of both grain and straw are said to be increased. Some 500 farmers have taken up the treatment of the seeds, which is followed by a very careful drying in a kiln. The treatment is applied about a month or two before sowing.

Electrical Fume Mask.—Fine fumes are commonly more difficult to absorb than gases, and this difficulty was experienced in dealing with the poisonous materials used in the war. The charcoal gas mask is adapted to the absorption of gases, but in order to absorb the fumes an extra filter would be necessary, adding to the difficulty of breathing. Some time ago an electrical fume mask was experimentally developed with the idea of condensing the fumes by electrical discharge, and a short account of these experiments is given in a paper by W. W. Strong and summarized in the *Physical Review*. A small induction coil is used, the electrical element being supplementary to the ordinary gas mask. The weight of the mask had been reduced to 2 pounds, but at the date of the armistice the life only amounted to several hours, a period which was much too short and would have required lengthening.

Electric Furnace Facts.—Twenty-five and 60 cycles are both being used for electric furnace supply. The use of 25 cycles permits of a greater power input to a given furnace than does the use of 60-cycle energy, due to the lower magnetic losses and decreased heating and inductive effects of the higher periodicity. A very much better power-factor exists with 25-cycle energy than with 60-cycle energy, for the same reasons, and these same factors apply to the maximum power input feasible. At the present time, continues *Electrical Review*, the largest electric furnace operating on 60-cycle supply is rated at 15 tons of steel. Experience has shown that a furnace for melting steel can take a molten charge of about 30 tons and will require about 2,000 to 2,500 kw. to handle this amount of metal satisfactorily. Such a furnace can be operated from a 60-cycle supply at 60 cycles. For a three-electrode furnace about 3,000 kv-a. probably represents about the limit as imposed by economy. A furnace of this size, handling molten metal, should be capable of producing from four to five thousand tons of steel per month, with an input varying between 2,000 and 2,500 kw.

Straight Detection vs. The Oscillating Tube.—In a report of the test submitted by the Naval Aircraft Radio Laboratory a preference is expressed for straight detection and high amplification in the reception of spark signals, instead of the present system using the oscillating tube. This brings up a question that has been much discussed. All of the research work done in the development of radio compass apparatus at this laboratory has indicated that reception of spark signals by means of the oscillating tube produces a much sharper minimum than that obtainable with detection and amplification. A rather lengthy and thorough investigation was carried on and a comprehensive report submitted. This report concerned itself mainly with the relative advantages of damped or undamped wave reception in connection with radio compass operation. The data obtained in that report gives good evidence in favor of the oscillating tube method of reception. It is perhaps true that for a green operator the true tone reception may be more pleasing to the ear and for psychological reasons result in better bearings, but the generally expressed opinion of experienced radio compass operators favors the oscillating tube method. An important factor in this connection is the question of upkeep; the oscillating tube method requires but two stages of audio frequency amplification, while for straight amplification, to give the same signal strength, several stages each of radio and audio frequency amplification are required with consequently more expensive apparatus and higher upkeep.

Science

No Locusts in the Philippines.—The Philippine Bureau of Agriculture announces that in consequence of energetic campaigns against locusts, no swarms of these insects have been reported anywhere in the islands since September, 1917. This is a condition that has not existed previously at any time since the earliest settlement of the archipelago.

Another Cruise of the "Carnegie."—The magnetic survey yacht "Carnegie," after lying out of commission at Washington for a year, was fitting out at the end of September for a new cruise (her sixth), to cover a period of two to three years. Her route this time will lie mainly in the South Atlantic, Indian and Pacific Oceans, the ports of call for the year being Dakar, Rio de Janeiro and St. Helena. J. P. Ault is in command.

A Cheap Method of Producing d-Mannite has been developed at the Bureau of Standards in the course of investigations carried out on behalf of the Medical Corps of the Army. This substance is used in the differentiation of bacteria, as well as for other purposes, and its large-scale production has been undertaken by the Bureau. In the new process pure white crystals of *d*-mannite are obtained by two crystallizations from the crude manna.

A Monumental Work on Cacti.—From time to time we have recorded the progress of the botanists N. L. Britton and J. N. Rose in preparing, for publication by the Carnegie Institution of Washington, an exhaustive systematic work on the cactus family. The first volume of this important work has been issued as Publication 248 of the institution. It deals with the tribes Pereskieæ and Opuntieæ, and is copiously illustrated, in part with colored plates. The other volume will be devoted to the Cereæ tribe.

Changes of Ground Level in Crete.—In the course of a discussion on the subject of Crete at the Royal Geographical Society, Prof. J. L. Myres described the remarkable changes of ground level that have occurred there since classical times. The whole island has swung upon an axis, the eastern half sinking and the western rising, so that whereas at Hierapetras and Spinalonga the ancient quays and harbor works are now under water, the little Greek harbor of Phalasarna, at the west end of the island, is now totally upheaved, so that one can walk about on the floor of the ancient harbor, upraised and dry.

New British Wheats.—Sir Daniel Morris stated at the last meeting of the British Association that as a result of the recent plant-breeding work done by Biffen, at Cambridge, new wheats have been grown over extensive areas in eastern England, yielding crops at the rate of 50 to 60 bushels per acre, and even 77 bushels in the case of one area of 27 acres. The average yield in England is 32 bushels per acre. Besides being more productive, the new wheats are less liable to disease and make better flour than the ordinary English wheats. In India, the Pusa wheats, developed by the Howards, will soon be grown over an area of 5,000,000 acres, and are expected to increase the value of the wheat crop in India to the extent of $25,000,000 annually.

Peyote Ceremonies and Uses.—The peyote, often popularly miscalled "mescal," through confusion with the maguey cactus from which a fiery intoxicant is prepared, is a species of small cactus widely used for both medicinal and ceremonial purposes by the Indian tribes of the southwestern United States and a great part of Mexico. The first careful study of its ritual uses was made by James Mooney, of the Bureau of American Ethnology, in 1891, and a digest of the subject will be found in the Handbook of American Indians. The peyote cult has been highly developed and has attained greater territorial extension since Mr. Mooney's original studies were made. Accordingly, last year Mr. Mooney accepted an invitation from the various tribes, with which he has long-standing friendly relations, to make further observations of the medical and ceremonial uses of peyote, and spent several months in these studies among 20 tribes in Oklahoma, as well as others in the United States and Mexico.

Aeronautical

Is Commercial Flying Dangerous?—The report of the British department of civil aviation today shows that 21,000 flights were made and 52,000 passengers carried with only thirteen accidents since the official opening of the service in Great Britain last May.

Commercial Air Service in Philippines.—A recent 1,110-mile flight by a Curtiss "Seagull" touching the principal islands and cities of the Philippines and demonstrating the efficiency of aircraft as carriers for the Philippine Health Service, the mails, passengers and merchandise, was one of the events marking the beginning of active commercial aviation in the islands.

Our American Aces.—Final records of the American Air Service, as reported in the *U. S. Air Service* magazine, show that 66 American aviators became aces during the war. These men were with the British, French and American Air Services. In naming the American aces both enemy airplanes and balloons are counted. The 66 men destroyed 489 enemy aircraft, according to official records. The actual number, of course, was higher.

Experiment in Hovering Flight.—Capt. Hamersley has been making experiments at Hamble, England, in hovering flight. He took up the Avro "Baby" recently in a wind of about 40 miles per hour, faced the wind, and throttled down. By nicely calculating the respective strengths of thrust and drift, he succeeded in remaining in the same spot over the airdrome for about five minutes. The spectators say that it was a most curious flight.

Double Liberty Motor.—The United States Air Service authorities have constructed a 24-cylinder Liberty engine by the process of joining two upper crankcase halves, each with its 12 cylinders, one inverted and the other the right way up, and making certain alterations to the connecting-rods. It is reported that the engine thus constructed gave 673 horse-power, weighed 1.97 pounds per horse-power dry, and used 0.55 pound of fuel per horse-power-hour.

German Airship Record.—According to the German official wireless the passenger airship "Bodensee," which is owned by the Hamburg-Amerika Steamship Company, accomplished a new record on November 20th last by making the 400-mile journey from Friedrichshafen, on Lake Constance, to Berlin in 3¾ hours. While the wireless report says nothing about the conditions of the flight, it goes without saying that the dirigible which makes a normal speed between 55 and 60 miles per hour, must have had a very strong wind blowing in the proper direction.

Air Travel De Luxe.—The *Times* of recent date states that the Handley-Page Transport Company has introduced, in connection with its air services, the novel feature of a luncheon basket, consisting of a small carton containing six sandwiches, fruit, and chocolate, at a cost of $0.72, while wicker holders for bottles and glasses are affixed to the walls of the stateroom. Up to October 4, fifteen London-Paris trips had been accomplished by this company each way, with a total of 219 passengers and approximately 6,000 pounds of freight, and nine London-Brussels flights each way, with an average of six passengers per flight.

Aerial Impressions.—Flyers, comparing notes about their impressions aloft, are unanimous that the panorama of earth quickly becomes rather monotonous. It depends on the landscape, of course, but in a general way one countryside is remarkably like another, and even between countries the difference appears small. On the London-Paris route, in the south of England, the pastoral pattern is cosier and more "nooky" than in the north of France, where, again, the stretches of unenclosed fields marked off to the eye only by their different shades of yellow and russet present the appearance of wide ranges of parquet-flooring, according to a writer in the London *Morning Post*. The monotony referred to is largely due to the fact that landscape when seen thus has become still-life. Every object is recognizable, but it is dead. No animal in the field moves. You can read the signs of human activities, but see none. There seems not a breath of wind in the trees, though it is blowing 50 miles an hour round your machine!

On River and Canal

What the Government Is Doing to Bring These Waterways to the Level of Use Maintained by the Lakes

By Robert G. Skerrett

FIFTY and sixty years ago the United States, like Europe, possessed canals and used its natural waterways. Where we had no rivers we made artificial ones. Names like Delaware and Hudson, Lehigh and Hudson, Morris and Essex, recall vanished days of canal-borne traffic; days which conceived and brought to fruition the ambitious project of the Erie Canal itself.

But with the development of our vast coal resources and our craze for speed, the rise of the railroads, through the fifties and sixties and seventies, brought about the fall of our inland waterways; and a generation has passed since any serious effort has been made to utilize the latter as they might be used and as they have been used for many centuries in the more frugal countries of continental Europe.

One of forty steel barges under construction for service on the lower Mississippi

But now the railroads are at an impassé. They cannot handle the transportation situation, complicated as it is by vastly increased production and shipment alike of raw materials, of food and of finished manufactures. So we must again call in the river and the canal. The National Government has not been oblivious to conditions. If we are to use our rivers and canals we must first of all have suitable hulls; and under the U. S. Railroad Administration substantially $50,000,000 has been set aside for the creation of a fleet of shallow-draft craft especially suited for employment upon some of our inland water routes, as well as for the construction of the necessary terminal facilities. These vessels include tug boats, self-propelled barges, and barges and lighters of different sorts; and all of them are modern steel structures admirably patterned to meet the physical conditions peculiar to the different sections of the country in which they are intended to operate. The heartening fact is that we are in a fair way thus to obtain types of boats that will form a nucleus for still greater things and set an example to private interests which for years have held back from venturing capital in water transportation in districts where nature has offered avenues of relief from dependence upon the land lines that dominated the transportational field to the disadvantage of the public at large.

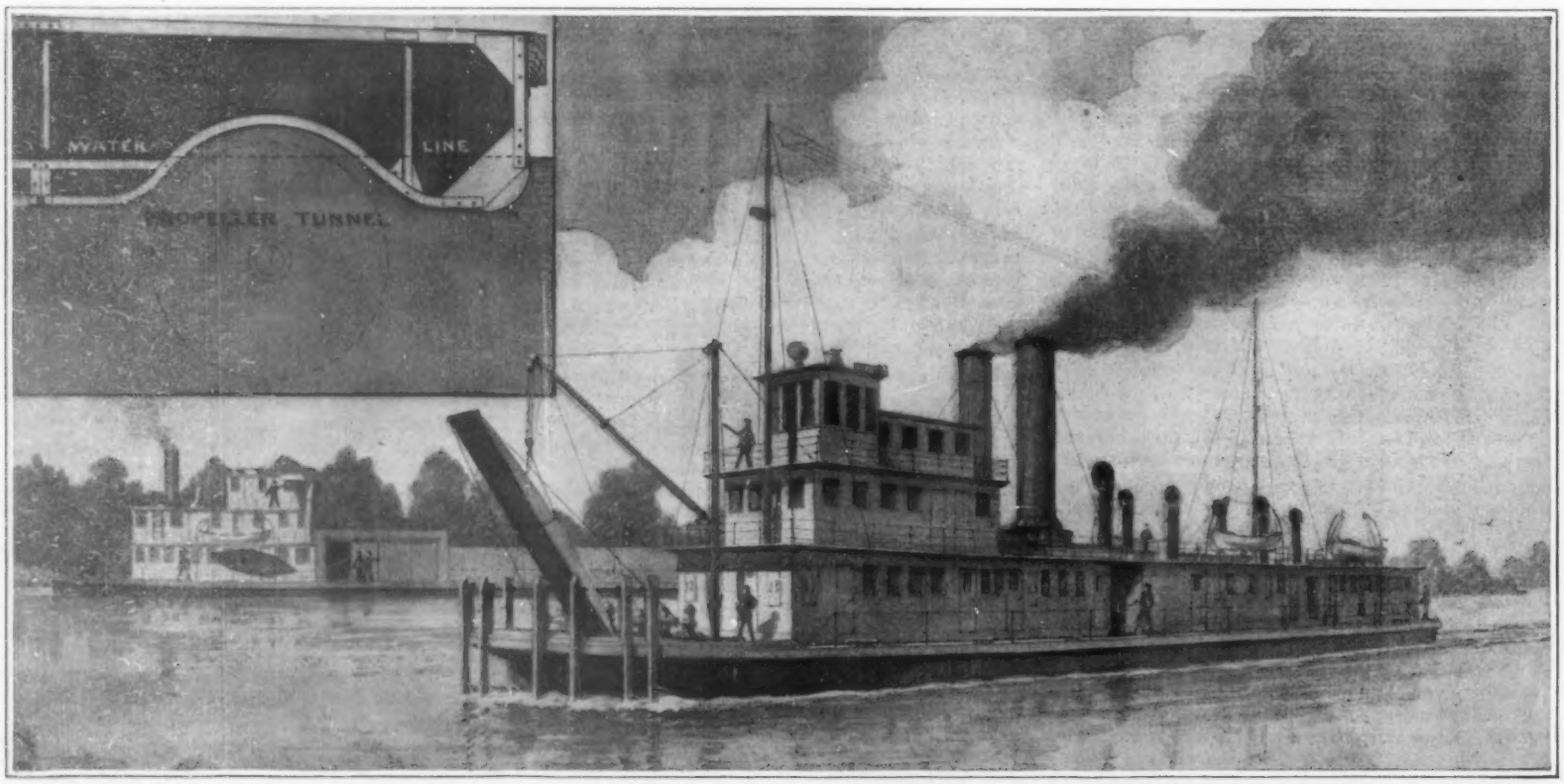
Our Government's movement to speed up the transportation of bulk commodities by recourse to water marks a rebirth of a system of traffic which is bound to affect our economic life profoundly if the people stand squarely back of private enterprises of this character. The underlying problem is one of bringing the producer and the consumer together in every way, and water routes reach into parts of our land that now deliver their products laboriously and under difficulties to the regional railways. Because of this, many raw products and other essentials go to waste or are denied access to the markets that would welcome them.

THE people of the entire United States realize today as never before that transportation is the nation's greatest need. They have had it brought home to them that the railroads have practically reached the limit of their abilities for public service, and that further needs must be satisfied through some other agency. In one direction this spells the opportunity of the motor truck; in another it means that we must now use our navigable waters as a part of the transportation system of the country. In the present article Mr. Skerrett exhibits facts about Government activity in the direction of waterways utilization which show clearly that this problem is getting the attention which it claims.—THE EDITOR.

The program at present in hand by the Railroad Administration will shortly provide craft for use on the New York State Barge Canal, on a part of the Mississippi River, and on the Tombigbee, the Alabama, and the Warrior Rivers. This flotilla will be composed of quite 124 vessels of three types. The allotment planned provides 20 self-propelled cargo barges and 51 tow barges for the New York State Barge Canal; 6 tow boats and 40 barges for the Mississippi River; and 3 tow boats and 4 self-propelled barges for the rivers of Alabama. Some of these vessels are designed primarily for the transportation of coal, pig iron, and petroleum, while others will be expected to handle cotton, farm products, goods from factories and miscellaneous freight.

Technically, the most interesting of the fleet are the tow boats and the self-propelled barges. The problem has been to develop screw-propelled vessels of light draft, and to this end tunnel sterns have been devised which insure a full head of water for the wheels even though the upper limits of the blades project above the load-line.

The self-propelled barges have an overall length of 280 feet, a molded beam of 49 feet, a molded depth of 10 feet, and draw 7 feet of water when full laden. They are being built of steel, and will be able to carry quite 2,000 tons of freight—1,600 tons of this will be coal and the rest package shipments. The propelling machinery consists of two engines of the inverted-cylinder triple-expansion type. When full laden these barges will be able to do 8 miles an hour. They will operate under natural draft and will burn bituminous coal. They will be lighted throughout by electricity.



Types of shallow-draft tow boats and self-propelled freight barges now building by the United States Railroad Administration for use on inland waterways. The insert shows a half cross-section of the stern of a twin-screw tow boat with propeller tunnel

Left: A building with fire-resistive roof which did not burn although in the direct path of the flames. *Right:* A striking view showing how the fire spread through a shingle-roofed district.

Monuments to the wooden shingle from the Atlanta conflagration

For the Alabama rivers the tunnel-stern tow boats will have an overall length of 140 feet, a molded beam of 24 feet, and a maximum draft of 6 feet. The motive power will consist of 2 triple-expansion engines of the type already described for the self-propelled barges, and steam will be furnished by two Ward boilers fired with coal. With an idea to increasing the maneuvering facility of these boats it is planned to provide them with four rudders—one forward and one abaft each of the twin screws. By thus placing the rudders in the direct sweep of the propeller races the craft will in all probability respond promptly to the helm at all speeds. These tow boats will be lighted throughout by electricity and thoroughly ventilated so that they will be comfortable in the warmest weather. The pilot-house is placed higher above the water-line than is usual with tug boats of this size in order that the helmsman can command a clear view in all directions. A powerful searchlight crowns the pilot-house as an aid to navigating tortuous channels after nightfall.

The most interesting craft of the program are the tow boats building for the Mississippi River service. These will have a length of 200 feet, a molded beam of 40 feet, and draw but 6 feet of water when full laden. As in the case of the Alabama River tugs the pilot-house stands even higher above the water-line, thus insuring both all-around vision and a long range of observation either night or day—the searchlight serving to illuminate the waters far ahead after dark. Like the other self-propelled craft already mentioned, these tow boats will have twin screws. At full speed the combined power of the engines will be 1,800 indicated horse-power. Two water-tube boilers, oil fired, will generate the needful steam. These tugs, besides being equipped with electric lights, will carry a wireless set possessing an effective radius of fully 600 miles.

These vessels are being constructed of steel, and are designed to meet the requirements of the American Bureau of Shipping. Special attention has been given to the arrangement of watertight bulkheads as a means to protect the boats in case they run foul of subaqueous snags or collide with barges, etc. The hull form has been developed after exhaustive study and with due regard to the peculiar circumstances of service on the Mississippi River.

The steel cargo barges for the Mississippi River have a length of 230 feet on the deck, a molded beam of 45 feet, and a draft of 8 feet when carrying 2,000 tons of freight. The intention now is to use them to transport miscellaneous cargo and bulk oil between St. Louis and New Orleans. They are modeled with long easy raking ends and rounded bilges, which should make them comparatively easy to draw or push when working up stream against swift currents. Each tow boat is expected to handle a group of six of these barges. The cargo box, which is above water, has eight openings on each side, 14 feet by 16 feet, with double sliding doors. The hold in each of these barges is divided into 18 compartments by wing and transverse bulkheads—the wing compartments being oil-tight. Pumping arrangements for handling cargoes of oil will be installed.

The steel barges for the New York State Barge Canal will have a length, inside of the fenders, of 150 feet,

(*Continued on page 171*)

Building to Burn

IT is a regretable fact but nevertheless, true, that the average American city is built to burn and not for safety. That this condition exists is, no doubt, due to the fact that with timber cheap and usually convenient, it has been natural that we have become a land of wooden buildings. And as a further result, we yearly reap a harvest in the shape of a $2.76 per capita fire loss.

This sum does not seem so very large until it is examined as a total that reaches $231,628,040 which was the sum represented by the losses in 1918. The sorry part of it is, as one authority remarks, that the average citizen reads and runs, and heeds not the dire possibilities that hang over his own city.

That wooden shingles are responsible for a large percentage of the total fire loss of which 65 per cent is dwelling house fires, may be a fact that is surprising. Certain it is that the wooden shingle is *always* responsible for the spread of a fire into a conflagration that will affect and involve such a number of buildings in the total loss covering a large district.

Figures have been prepared that prove this conclusively. In the Paris, Texas, conflagration that destroyed several millions of dollars' worth of property which included 704 dwellings, 192 mercantiles, 522 servants' houses, garages and stables, 22 churches, schools and public buildings, it was found upon investigation that of all the buildings involved 73 per cent had combustible roofs and 90 per cent were wooden or frame buildings. The fire, unfortunately, started in the residence section with the usual number of shingle roofed dwellings and spread so rapidly that firemen were unable to check the flames although they used vast quantities of dynamite in a determined effort that failed because of the wooden roofs.

This three-piece concrete shelter serves as outdoor telephone booth

The Atlanta, Georgia, fire ranks with the major conflagrations and a report rendered after the fire and consequent investigation places the blame for the rapid spread of the destroying flames on the shingle roofs. Sparks blown by a moderate wind lighted on the shingle roofs and were responsible for a series of fires raging at once and one of the spectators makes a statement that at one time over seven distinct fires were raging.

Investigators of this fire covered the field carefully and made their reports upon the evidence found and their version must be accepted as true in every respect. As a direct comparison of the non-inflammable roof against the shingle variety it was found that in one burned district every shingle-roofed dwelling had been completely destroyed and one dwelling, roofed with non-inflammable material had not been burned. This house, which is shown in the illustration, was entirely surrounded by burned houses but had been saved by directing a hose on the roof, although the heat was so intense that windows were broken by it and the side of the house scorched.

Minor conflagrations, involving the total loss of millions of dollars and hundreds of lives in Bangor, Maine; Jacksonville, Florida; Yazoo City, Mississippi; Chelsea, Massachusetts; Fort Worth, Texas; Houston, Texas; Hot Springs, Arkansas; Salem, Massachusetts; Nashville, Tennessee; Augusta, Georgia; all have their rapid spread traceable to the agency of the shingle roof.

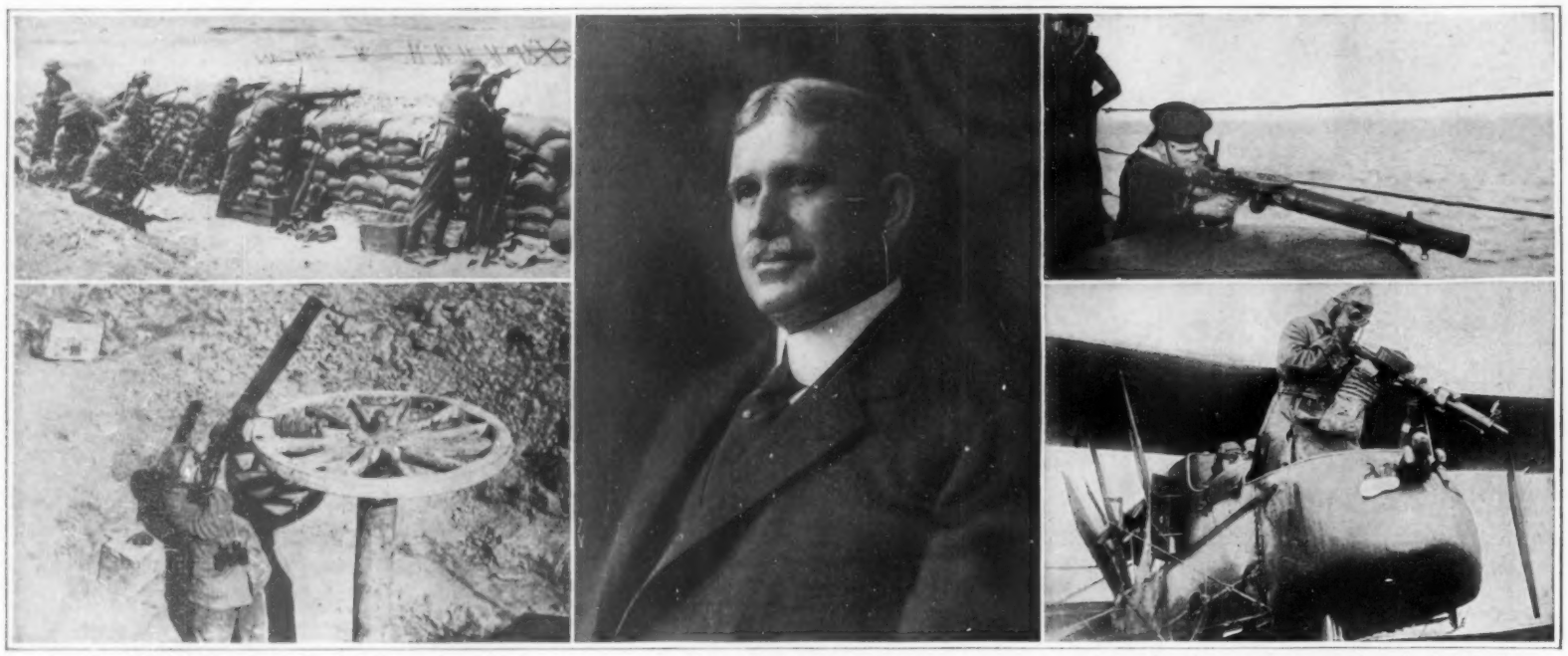
Even in this year the fire that destroyed 191 buildings in Mobile, Alabama, is attributed to the wooden shingle as an official report on the matter states: "The failure to control this fire before such heavy damage was done was due to a heavy wind and to 92 per cent of all roofs being shingle and all buildings being frame construction, the wind carrying the embers to the other shingle roofs and setting the roofs on fire faster than they could be extinguished."

Individual fires are also traceable to the shingle roof for it is found that in Salt Lake City last year there were 304 destructive fires and that over 17 per cent were due to blazes originating on shingle roofs. In Indianapolis a record has been kept covering a period of nine years. The data is as follows: In

(*Continued on page 171*)

Concrete for Safety Telephone Booths

THE unsightly wooden telephone booths appearing along the tracks of electric railways will before long be replaced by concrete ones. This new design has recently been brought out by a Chicago manufacturing concern, who are making use of concrete in the construction of them. The booths are made in three sections, body, base and top and are thus easy to transport from one place to another, and are said to be lighter in weight than most booths. Electrical telephone connection is such that the locking and unlocking of the door automatically cuts out and cuts in the telephone. Provision is made within the booth for a wooden shelf upon which to place the telephone. Upon the floor is placed an extra wooden floor lightly insulated to act as a positive means of insulation. A panel in the door provides for sufficient light while telephoning. The concrete booths are fire proof, not easily broken into, and are comparatively permanent.—*K. H. Hamilton.*



Above: The Lewis gun in the Egyptian campaign
Below: Extemporized mount for anti-aircraft work

Colonel I. N. Lewis, U.S.A.

Above: Lewis gun practice on board a battleship
Below: Stripped and mounted on a bombing plane

The Romance of Invention—VIII

The One-Man Machine Gun and Its Inventor

By C. H. Claudy

"IF I can invent something which the Government wants and sell it in quantities, I can get rich on royalties."

There is nothing inherently wrong with such an attitude of mind. The Government must buy what it needs and expects to buy it at a profit. But there are some men who think that the devices they invent, which their government needs either in war or for purposes of war, should belong to it without thought of money or of price. There has been more than one example of such an attitude during the present war, but none more inspiring than that of the inventor of the Lewis gun, who refused to accept from his government royalties on the manufacture of this arm, and insisted upon a business arrangement by which more than one million dollars which was legally, rightfully and properly his share in royalties, was turned back to the treasury of the United States.

This is not to be a controversial article, nor to rake up the dead ashes of the fire which has blazed about the Lewis machine Gun and the Ordnance Department since the memory of man runneth not to the contrary. The controversy has lost its point since the war, anyway, since other governments demonstrated what this one did not . . . that the Lewis machine gun is a practical, serviceable, German-killing mechanism, and, for its purposes, better, simpler, more easy to manufacture and operate than any other which saw service.

It must be a great satisfaction to Col. I. N. Lewis, U. S. A., retired, to know that his arm was responsible for killing more Germans than any other individual death-dealing device used on the battlefields of Europe. At the time of the armistice, more than a quarter of a million Lewis guns were functioning in France and Flanders. There were so many more Lewis guns in the British army than any other kind that British machine gunners were known as "Lewis gunners" regardless of the make of machine gun which they handled.

They were not only used on the ground, both as an offensive and a defensive weapon, but in the air; the Lewis gun was the first machine gun ever to be fired from an airplane, when Captain (now Colonel) Chandler of the Signal Corps took up a Lewis gun in a Wright machine and made fourteen hits out of fifty shots, at College Park, Md., in 1912.

The Lewis machine gun is undoubtedly the greatest contribution which Col. Lewis's inventive genius has given to the world, but it is by no means the only one. He has been prolific of inventions, many of which are in use in the army today.

The list is a long one but among the many things he has conceived and wrought to a state of practical use are the first successful replotting and relocating system for coast batteries, a time-interval clock-and-bell system of signals, quick reading mechanical verniers used in coast defenses, the depression range finder (which determines range from coast gun stations by measuring the angle between object at sea and position elevated above the sea level, and which is more accurate in such determination than the gun is in hitting the object), a horizontal range and position finder, an automatic sight, a speed indicator for locomotives, a photographic time recorder, a self-regulating differential dynamo which puts out a steady current at varying speeds and loads, an automatic electric cut-out switch, an automatic pole changer for dynamos, etc., etc.

Many of these devices are of sufficient interest to the public to deserve more extended mention, but none of them makes that popular appeal which is found in the light machine gun—the device which captured Jerusalem and which makes two men so armed the equal in killing power of twenty-five infantrymen. Had the war continued, the United States would have been able to put in the field some three hundred thousand machine guns a year . . . a third of these would have been Lewis guns and the other two-thirds Browning, Marlin, Vickers, Maxim, Schwarzlose, etc. Three hundred thousand guns, six hundred thousand gunners, would easily equal fifteen million infantry equipped with rifles, as far as killing power is concerned. Had everything else gone wrong, there was even yet no chance for a final German win, with such statistics being rapidly translated into facts.

IT is certain that no one weapon did such signal execution in the war as the machine gun. Certainly, none so greatly dominated military tactics. Hence, particular interest attaches to the man after whom some 250,000 of these weapons on the fields of France and Flanders were named. As Maxim is the father of the machine gun, so Lewis is the father of the light machine gun. The story of his unsuccessful fight to introduce his great invention into the Army has well earned for him the title of "the stormy petrel of the Ordnance Bureau." Reluctantly, he carried his invention abroad, where he made good. He made good again when his own country, in the stress of the great war, called for his weapon; and he made lastingly good when he filled the orders and refused the one million dollars of royalties which was his due.—THE EDITOR.

The Lewis gun—which is a development of the first "one man" gun of automatic firing mechanism ever conceived—is not, and should not be considered as, a competitor of other makes of guns with which it is frequently contrasted. One does not consider an infantryman's rifle as a "competitor" of a French .75, nor the pistol an officer carries as "competing" with a trench mortar.

There are three classes of automatic machine guns in general use. These are, the heavy, fired from a substantial tripod and used mainly for defensive purposes, belt fed and water cooled; the light automatic rifle, without any cooling system, gas operated and magazine fed, and similar in weight and portability to any other shoulder arm; and finally the intermediate type, which has more mobility than the heavy type, but possesses also a greater degree of durability and of accuracy than the light arm, and which can sustain continuous rapid fire for a considerable period.

The Lewis gun is of the intermediate type. It weighs twenty-six pounds and can thus go wherever infantry can go, carried by one man. In service two men are required, the second to carry and handle the magazines with the ammunition, but the gun is carried and operated by a single man. It is made of sixty-two separate parts, which can be assembled or dis-assembled with no other tool than the nose of one of its own bullets. It is, of course, built to interchangeability precision so that half a dozen guns can be dis-assembled, their parts piled in a heap and mixed, and six guns reassembled therefrom, each of which is a different gun from any which were taken down, yet each of which is as perfect and as good as any other Lewis gun.

The outstanding features of the gun which have made it recognized on the field as the preëminent light machine gun are its simplicity, its accuracy, its reliability and the fact that it is air-cooled. The heavy types of machine guns are, and must be, water cooled, but water is not only heavy to carry but not infrequently difficult if not impossible to obtain on the battle front. Guns without cooling systems get too hot to fire after a few minutes of rapid use. The air-cooled gun can fire two thousand rounds if necessary and still be in condition to be picked up in the hand.

This air cooling feature is accomplished by an outer

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The Exploring Rocket

The Missile That Could Be Shot to the Moon, and Its True Purpose

THE great popular interest taken in the Einstein pronouncement has apparently made the daily press more than ordinarily keen for scientific and pseudo-scientific news, and of course the journalistic nose can always be depended upon to ferret out whatever of the sensational may inhere in such news. Accordingly when Dr. Robert H. Goddard of Clark University, in an account of apparatus invented by him for the purpose of exploring the extreme upper strata of the atmosphere, mentioned casually the possibility of giving this apparatus sufficient driving power to carry it to the distance of the moon, this item was seized upon as the feature of the story and the hook on which to hang the headlines. It is a fact that so far as calculation and experiment enable us to foresee, the rocket which Dr. Goddard has developed would carry to the moon, and on striking the moon's surface it would certainly produce a flash which could be seen telescopically from the earth. Dr. Goddard mentions these facts as a suggested means of verifying the calculated range and the accuracy of fire, and for no other purpose whatever; yet the only idea one could possibly take away from the current accounts of his invention is that it was designed with the sole intent of bombarding our satellite.

The fact is that the greatest altitude at which soundings of the atmosphere have been made by balloons, namely about 20 miles, is but a small fraction of the height to which the atmosphere is supposed to extend. Indeed, the most interesting, and in some ways the most important, part of the atmosphere lies in this unexplored region a means of access to which has, up to the present, not seriously been suggested.

A few of the more important matters to be investigated in this region are the density, chemical constitution, and temperature of the atmosphere, as well as the height to which it extends. Other problems are the nature of the aurora, and (with apparatus held by gyroscopes in a fixed direction in space) the nature of the α, β, and γ radioactive rays from matter in the sun as well as the ultra-violet spectrum of this body.

Speculations have been made as to the nature of the upper atmosphere—those by Wegener being, perhaps, the most plausible. By estimating the temperature and percentage composition of the gases present in the atmosphere, Wegener calculates the partial pressures of the constituent gases, and concludes that there are four rather distinct regions or spheres of the atmosphere in which certain gases predominate: the troposphere, in which are the clouds; the stratosphere, predominatingly nitrogen; the hydrogen sphere; and the geocoronium sphere. This highest sphere appears to consist essentially of an element, "geocoronium," a gas undiscovered at the surface of the earth, having a spectrum which is the single aurora line, $557\mu\mu$, and being 0.4 as heavy as hydrogen. The existence of such a gas is in agreement with Nicholson's theory of the atom, and its investigation would, of course, be a matter of considerable importance to astronomy and physics as well as to meteorology. It is of interest to note that the greatest altitude attained by sounding balloons extends but one-third through the second region, or stratosphere.

The search for some means of raising recording apparatus above an altitude of 20 miles led Professor Goddard to develop a theory of rocket action. He had to determine the minimum initial mass of an ideal rocket necessary, in order that on continual loss of mass, a final mass of one pound would remain at any desired altitude. That the problem to be attacked was practically a virgin one is sufficiently indicated when we learn that the best existing rockets of standard type develop an efficiency of barely two per cent, with an extreme vertical range of something like 500 feet. The vast improvement over this showing which was necessary, Dr. Goddard sought in two directions. To increase the velocity of ejection of the gases, smokeless powder was used and the charges were fired in strong steel chambers fitted with tapered steel nozzles designed to obtain the work of expansion of the gases as in the De Laval steam turbine. The efficiencies and velocities of ejection thus obtained were remarkably high—as great as 64 per cent for the one, and almost 8,000 foot-seconds for the other. Then to reduce the dead weight of the rocket, he determined to use small charges of explosives fired successively, as in a machine gun, so that the firing chamber would not have to be built very heavy. Thus most of the mass of the rocket could comprise propellant material. It was then found that surprisingly small initial masses would be sufficient; because the velocity enters exponentially in the expression for the initial mass. That is to say, if the velocity of the ejected gases can be increased five-fold, the initial mass necessary to raise the residual mass of one pound to a given height will be reduced to the fifth root of that required for the smaller velocity. In other words, if an initial velocity of 1,000 feet per second will suffice for a mass of 32 pounds, a velocity of 5,000 feet per second will be enough for a mass of 2 pounds, with the obvious extreme saving in energy that must be spent to work the given mass up to the given initial velocity.

An interesting feature of Dr. Goddard's experiments has been his investigation of the results of rocket action *in vacuo*. It may be necessary to remind some readers that the rocket does not acquire all its energy at once, like the ordinary projectile; and that it accordingly does not have to be shot from the earth's surface at any such velocity as seven miles per second in order to escape from the earth's gravitational field. The rocket carries up with it a quantity of explosive, which continues to burn and to give off energy; and which accordingly continues to kick the rocket upward until it is all burnt. Many of us have been taught that the action of the rocket depends upon the reaction of the escaping gases against the air; if this were so, obviously there could be no reaction *in vacuo*, and the rocket would have to acquire sufficient velocity in the denser parts of the atmosphere to carry it to its goal against the resistance of the upper strata and the pull of gravitation. But Dr. Goddard confirms what some at least of us have always known or suspected; the

(Continued on page 173)

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The Concrete House

To the Editor of the SCIENTIFIC AMERICAN:

I have been much interested in the articles that have been appearing in the SCIENTIFIC AMERICAN covering the development of the concrete house. It seems to me that these articles have overlooked a number of fundamental matters affecting concrete house building in particular, and I am therefore writing you this letter to bring out these points. An analysis of the use of concrete for house building brings out the following advantages:

1. Promises a large saving in labor costs.
2. Gives strength, permanence, and resistance to fire.
3. Enables great speed of construction if proper methods are used.
4. The source of raw material is practically inexhaustible, and its rate of manufacture is very rapid.

The more important disadvantages are:

1. Dampness. This can be overcome by providing air spaces but increases expense greatly.
2. In order to secure diversity in design and appearance, it is necessary to sacrifice many of the methods making for economy in construction costs.
3. The art of concrete house building is still in its infancy and there is as yet much uncertainty as to methods that should be followed.
4. The public is not yet educated to accept the concrete house.

Most of the articles mentioned are written from the attitude that producing low-cost houses is the main consideration. They have to do with the method developed by Mr. Edison, or modifications of it, or else use various methods of precast construction. In my opinion, they are in error, failing to consider the following fundamentals sufficiently:

1. While of course the provision of shelter, and consideration of structural strength and permanence are of first importance, the American standard of living is such that structures providing merely these things are salable or rentable only under pressure of a severe housing shortage. From 50 to 75 per cent of the sale value of the ordinary moderate priced house depends upon design, appearance and surroundings. When building construction has caught up with demand, houses built without properly providing for this factor will lose value rapidly and serious monetary losses are likely to occur.
2. Low cost is important, but the purchasing power of the average community is tremendous when the article that is both practical and pleasing is offered.
3. Houses built of so imperishable and permanent a material as concrete should be designed with particular care to insure their continued popularity, because their destruction will be unduly expensive.

My conclusion is that it is the part of wisdom to decide what standards in design, appearance, and construction will retain their popularity under all conditions that are likely to occur, and then to secure these building standards at the lowest possible cost. It then becomes a question of arranging sale terms, if the houses are to be sold, on a basis that the purchaser can meet. Very frequently this involves special financial arrangements and special educational methods, but enough has already been done in this direction to show that at least the major portion of the housing need can be met in this manner, and it is my belief that until the demand for houses built along these lines is fully satisfied, great caution should be exercised in building houses that are lacking in design, appearance or standard of construction.

R. P. BLAKE.

Philadelphia.

A New Cooling Medium

To the Editor of the SCIENTIFIC AMERICAN:

The question as to the feasibility of transforming the heat energy that is used up in the cooling system of gas engines into mechanical work has more than once been discussed in your columns. Yet I may be pardoned for asking a few questions in regard to the matter.

I understand from the discussions referred to that, while it is entirely feasible, the plan entails so many complications in construction and operation, that it could not be profitably employed in units of small output.

Now I should like to ask whether a mixture of air and water spray has ever been tried out as a cooling medium. Such a mixture would approximately obey the laws of gases, and if compressed into the jacket space of a gas engine, would not only seem a good cooling medium, but on emerging from the jacket space would be ready for use in some form of steam engine.

The mixing could be accomplished in a manner similar to carburetion in gas engines, except that in this case it would be "hydration." If the compressor were run from the crank shaft every power impulse given to the engine would also bring a definite quantity of cooling mixture to the jacket. The matter of adjustment would not be dissimilar to that of adjusting a carburetor. To take care of the fluctuations in the requirements of the cooling system, some form of thermostat could well be used. The thermostat could also be used to effect shortcircuiting of the magneto, thus stopping the engine, if for any reason the cooling system should fail to operate.

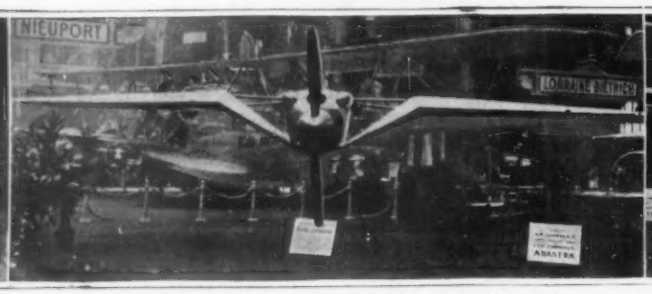
Why could not some such system be used in a tractor motor where lightness is not the first consideration, but the fuel question becomes daily more important?

I have in mind a three-cylinder motor, two cylinders being of the four-stroke cycle gas engine; the third, placed between the two first-named, a steam engine open at one end just as the gas engine cylinder. This steam engine to work on the same crank shaft with the gas engines, with crank set at 180 degrees from those of the gas engine. The working fluid to be the cooling mixture referred to in which the water spray has become steam. The exhaust from this steam cylinder could be returned to a specially designed radiator, where a portion of the steam would condense, and the water could be used over an indefinite number of times, as in the case of motor vehicles.

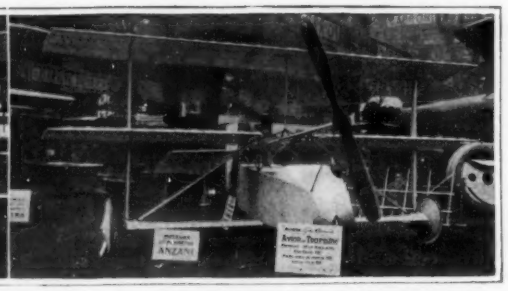
Does all this seem too airy to receive practical application? Why? FRIDOLIN MULLER.

Reedley, Cal.

The Besson hydroplane with powerful air screw



Clement's monoplane racer which has a landing gear that folds into the wings



Single-passenger triplane designed by Clement for sport purposes

Airplanes That Are Different

How the European Constructors Are Striking Out Along New Lines

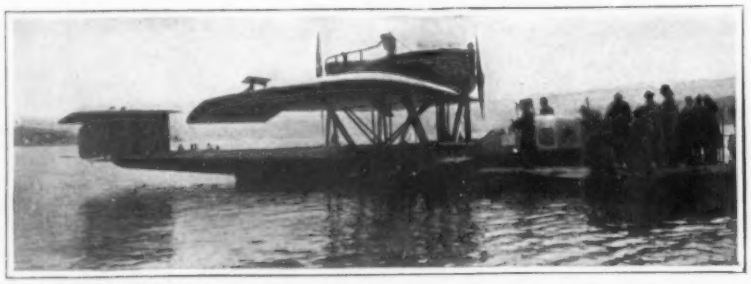
IN view of what has been accomplished of late in the field of aeronautics, it is well to grant a hearing to any idea that is presented, no matter how radical it may seem. For it is not so long ago that an all-metal airplane was considered more or less impossible of realization, yet the Germans have gone to work and constructed numerous all-metal machines—machines with bodies and plane surfaces of corrugated aluminum composition, which fly exceedingly well and stand the weather and other detrimental factors better than the conventional canvas and wood. Then there is the helicopter, which, we are told, is about to be realized. And so it goes with so many other speculative ideas which have been converted into stern reality within a short space of time.

The recent Paris Aero Show was more or less of a gathering of the latest airplanes and engines, although certain countries, particularly Germany, were not represented. The accompanying illustrations, with the exception of one, have been selected from among the Paris exhibits because of the unusual features of the machines depicted.

At a glance, the European constructors have turned to peacetime flying with the result that their efforts are represented by small sport machines with a carrying capacity of one, two or three persons, and the large passenger carriers with a capacity of 12 to 26 persons. In the case of the small machines the horse-power has been reduced to pre-war standards; thus, the small machine with a 35-horse-power engine is again in evidence. Then there are the moderate-sized passenger carriers and the postal planes.

The machines of the late war have undergone such a tremendous change in design that it is only with difficulty that one can identify a type here and there. The famous Spad, for instance, has been altered to such an extent that it is no longer the same machine; and the same can be said even more truly, if anything, of the famous Nieuport. The Morane-Saulnier machines—the smart parasol monoplanes of the recent aerial fighting—retain more or less their general war-time lines. However, there can be no doubt that such changes as have been made are for the purpose of obtaining better performance. Sadi Lecointe's recent official record of 192 miles an hour in a Nieuport, as well as his other records in modified Spad machines, testifies to the soundness of the new designs.

More and more constructors are entering into the construction of giant planes. There is the Handley-Page giant, the Farman "Goliath," the Bleriot "Mammoth," the huge Caudron, and many others. With horse-powers of 500 to 800 and with a tremendous rate of depreciation to contend with, it is a much mooted question whether such planes are really suited to commercial service. Many aeronautical men are inclined to favor the smaller machines, say of 300-horse-power and six-passenger design, because of the lower proportional upkeep and the slower rate of depreciation. It is simply a matter of splitting up the carriers into a greater number of units.



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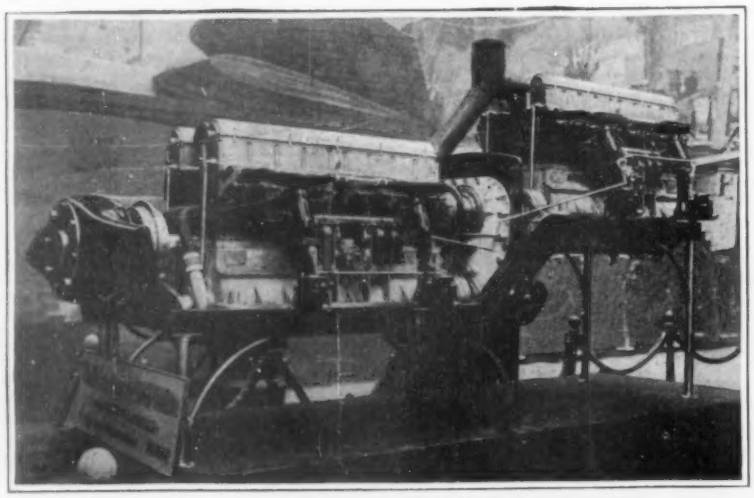
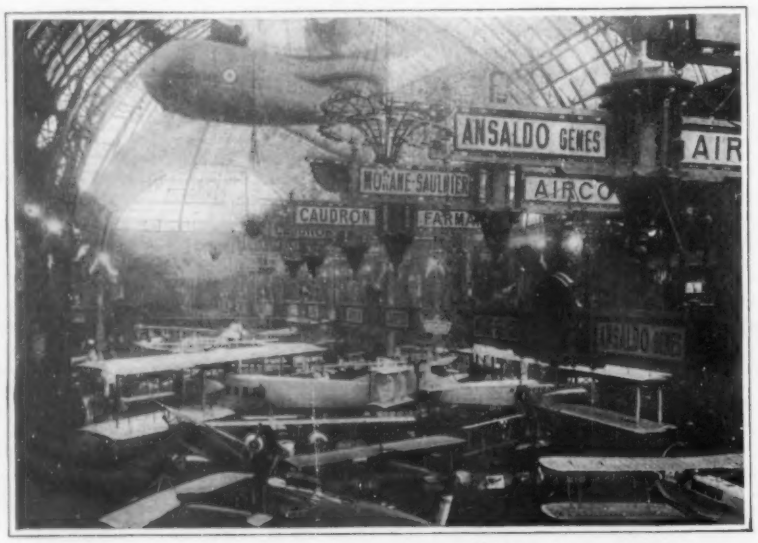
German passenger-carrying monoplane of novel design now employed at Swiss lake resorts



Breguet-Bugatti multiple power plant for a single propeller, rated at 800-1000 horse power



General view of the recent Paris Aero Show, with the Farman "Goliath" and Caudron giant very much in evidence

Coming to the real novelties of the Paris Show, we are attracted by the machines of Louis Clement. One of these is a little sporting triplane, single-seater, with a 35-horse-power three-cylinder Anzani engine. Metal is profusely employed in the construction of this triplane. The landing gear consists of wheels at the wing tips and a wheel in the nose of the fuselage. The propeller up front is driven by means of a long shaft.

Then there is Clement's bizarre racing monoplane, which appears to be a genuine effort to emulate the bird. It is provided with a 180-horse-power Hispano-Suiza engine. There is a break in the wings, the roots having a large dihedral and then straightening out. A horizontal cross-tube to the body forms the bracing. The V's of the undercarriage can be swung outward and the wheels then disappear in pockets in the lower wing surface. This idea is a step in the right direction. It is not exactly new, for many have suggested the retractable chassis before and at least one constructor has applied it in a different way. But the Clement racer is an interesting machine none the less, and something may be heard from it in the near future.

The Besson "hydro-glisseur" may be called the limousine for the river. It accommodates a number of passengers in a comfortable enclosed body, while the driver sits in a cockpit to the rear and above the cabin. The power plant is up forward, enclosed in an automobile type hood, and drives a large air screw through bevel gearing and shafting. Steering is accomplished by means of an air rudder. The hull is a stepped hydroplane.

As for motors, the Paris Show included a wide assortment ranging from the small 35-horse-power engines for sporting purposes to the powerful units for large passenger-carrying planes. One of our illustrations shows the Breguét-Bugatti multiple unit power plant of 800-1,000 horse-power for driving one propeller. It seems that such construction is bound to become common, once large passenger planes are introduced on a large scale and there is an urgent demand for reliability.

The remaining illustration shows a flying boat used for passenger service on the Swiss lakes. It will be noted that this machine is of monoplane design, with the wings and engines above the boat body. Two engines of 270 h.p. each, in tandem and driving a tractor and a propeller screw, comprise the power plant. One interesting feature of this machine is small auxiliary plane for balancing aileron. The machine, which is of German make, is entirely built of aluminum, with the exception of the planes.

From Coal Barge to Bunker

A Digging and Elevating Outfit of Interesting Design and Great Adaptability

By J. F. Springer

THE facts that the United Kingdom and the United States are the largest producers of coal and also the leading countries having to do with maritime shipping combine to make them the principal developers of apparatus for the transfer of coal from rail to ship. There are two principal purposes in such transfer—one concerns the loading of barges and colliers engaged in coal transportation; the other, the bunkering of ocean-going vessels. In the SCIENTIFIC AMERICAN for July 12th, 1919, will be found an account of one of the best American systems for the mechanical bunkering of vessels from supply barges. The present article deals with a first-rate British system of accomplishing substantially the same object.

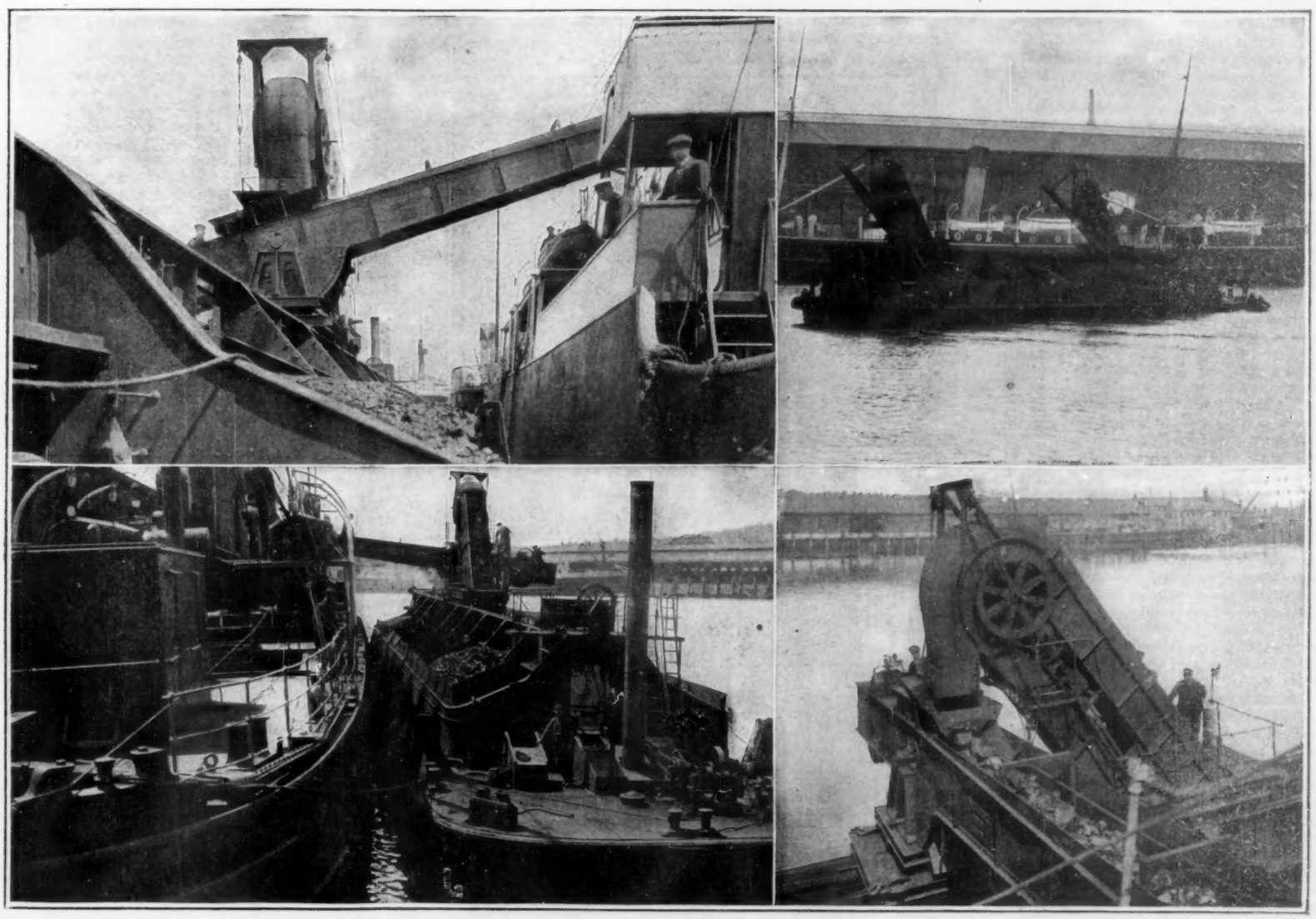
Before taking up in detail the principal British system in question, let us glance at a somewhat similar one which preceded it. This was the Rigg's system, dependent upon a floating elevator. There were six pontoons, each of them 6 feet in diameter and 20 feet in length. These were assembled in two parallel groups of three each. The pontoons supported a deck about 74 feet long and 24 feet beam. Mounted on this deck was a latticed tower, not dissimilar to the masts of American battleships. At its top was a revolving head. There were two latticed girders, curved at one end; and these were suspended from the revolving tower-head by means of wire ropes. These and other ropes were so arranged and the girders so disposed that the operation of the ropes by hoisting engines served to manipulate the long girders, it being possible to stow them lengthwise of the deck or to swing them round at right angles to it and hoist them into service position. The girders carried two endless chains of buckets which traveled upon rollers provided with flanges. The chains of buckets were power driven; and, when the girders were properly placed with one end in a coal barge, alongside, they served as diggers and conveyors of coal.

To use this system, the pontoon boat carrying the conveyors was stationed alongside a ship near the bunkering hatches. A coal barge was stationed on the other side of the pontoon boat. With the digging ends of the girders down in the barge and the other ends set to deliver to a supplementary conveyor, it was possible to dig coal from the barge, convey it up and across the pontoon boat, and make delivery to the ship.

The newer system combines the coal barge with the conveying apparatus. The method is in use by the London & North-Western Railway at Holyhead, off the west coast of the island of Anglesea on the east shore of St. George's Channel. The coaling device is employed to carry and deliver coal from railway cars to vessels. The "Herald," as a notable one of the bunkering barges is called, is 154 feet 6 inches long and 27 feet broad. This barge is of steel construction and contains two parallel rows of coal pockets, 9 in a row. Each pocket has a capacity of about 25 long tons, so that the barge may be loaded with 400 or 450 tons at a trip. It is understood that three ordinary carloads go into a pocket; this will give an idea of the diminutive size of the cars. The division bulkheads between pockets are of ⅜-inch steel plate reinforced by 2½-inch angle bars of the same thickness. The two rows of pockets are separated by a trench or well 4½ feet wide and 20½ feet deep. Along the sides of the well, at the top, are arranged the rails of a track on which two carriages operate back and forth. Each carriage is supported by three wheels on a side. The carriages support elevators of 58 buckets each. That is to say, each elevator is supported by two trunnions, and these trunnions are in turn carried by suitable bearings on a carriage. The wrought steel buckets are a yard wide. The lower ends of the elevators dip down into the well, but are kept clear of actual contact with the bottom.

The bottoms of the coal pockets are inclined, dipping towards the well. Next the well, the pockets have doors, each door consisting of two parts. That is, there is a lower half and an upper half. The entire opening may be put into service at once, or only the lower half. In the former case, the four clamps which secure the double door are all knocked away. If only one-half of the opening is to be used, then the proper two are knocked away and the half-door turned on its hinges. This folding of the door plate is accomplished by means of a hand-winch operating on the platform. The coal resting on the inclined bottom of the pocket will, when the doorway is partially or entirely opened, blow by gravity into the boot of the elevator, which has previously been properly adjusted to exact position. The operation of the endless chain of pockets results in coal being carried up. The drive

(Continued on page 173)



Above: The conveyor leading from the deck of the coaling barge "Herald" and a set of ordinary chutes attached to her elevator heads. *Below:* Coaling a steamer from the "Herald" and a close view of the head of the elevator-conveyor

How coal is delivered to the ship's bunkers from the Holyhead barges

Eliminating the Lost Call

How a Simple Telephonic Novelty Cuts Out a Vast Amount of Lost Motion in Office and Factory

By Robert G. Skerrett

THE bigger the business, the more expansive the factory or plant; and the more diversified the work of the associated departments, the greater the need of prompt contact with administrative and supervisory heads. These officials are the prime movers who translate into correct and coördinate action the energies of the subordinates who constitute the mass of the industrial organization. Similarly, the greater the responsibility of the executive, the more valuable his time and the more urgent the demand that he be within reach at a moment's notice throughout the hours of the working day.

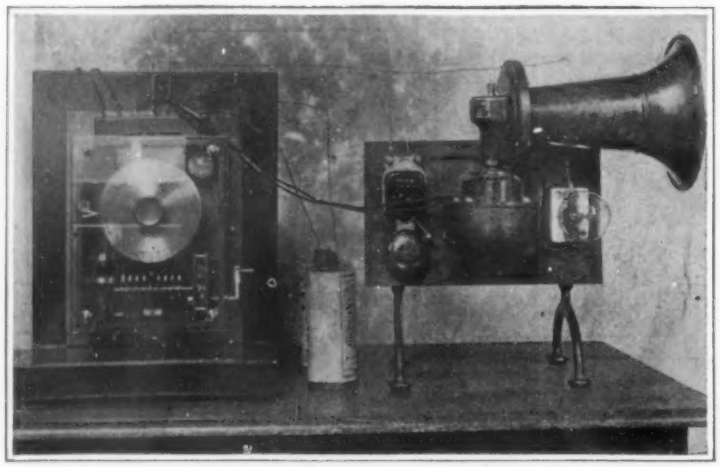
The telephone as ordinarily installed is only one means toward maintaining continual touch with the guiding minds of a large organization. At best, when the man or men in question are making their rounds of inspection or direction, "central" can locate them only by a hit-or-miss process—the vocal hunt possibly disturbing scores of busy persons in different parts of the plant. These interruptions entail loss of time and the sacrifice of services that come more or less high. Efforts are wasted and expense promoted without return, and all because an official, much needed at his desk, has somehow become "lost" in the maze of his establishment.

In a noisy or crowded department, the modest jingle of a summoning telephone may be "drowned," and only protracted ringing will succeed in attracting attention. Picture the distressing tax upon the switchboard operator; think of the confusion thus promoted throughout the intramural telephone system as she frantically pursues her quest from section to section. There has lately been brought out an installation, with suitable apparatus, which does away effectually with the difficulties described and locates the man desired instantly without impairing the plant's telephone service or disturbing valuable workers. No matter where the official may wander within the confines of his business he can be found and called to the nearest 'phone—"central" then putting him immediately in communication with those who need his counsel or decision.

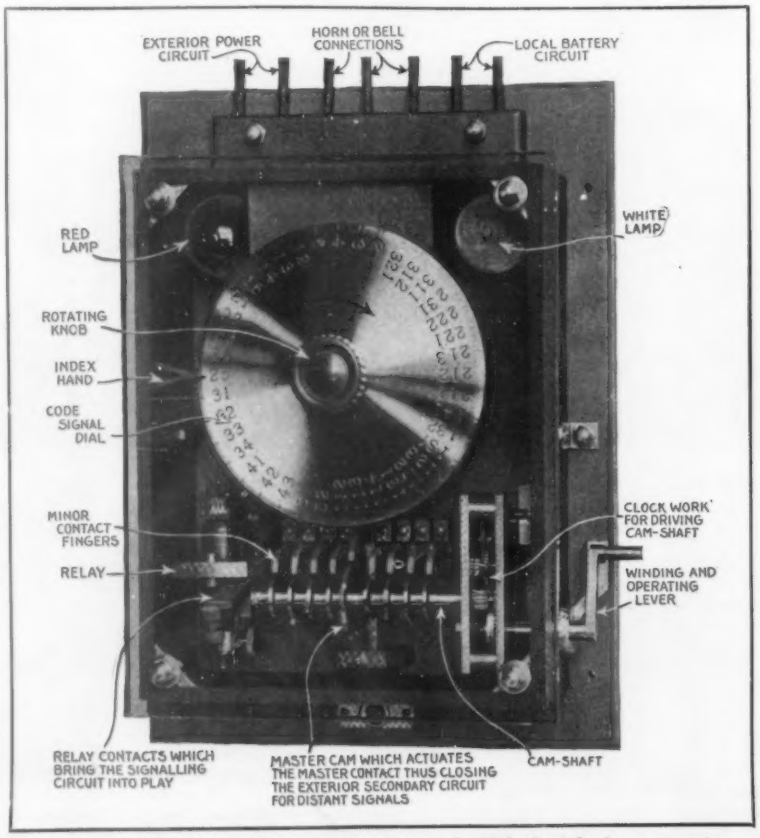
The character of the signalling medium is determined by the circumstances of its setting, and may range from a mere buzzer to the penetrating, far-reaching note of an electric horn kindred to some of those commonly mounted upon different kinds of automotive vehicles. The nature of the apparatus best suited to the particular environment, has been determined only after exhaustive research by Professor V. Karapetoff, of Cornell University, who has specialized for some while in what might be called "industrial acoustics." The primary aim is to obtain a note of such strength and quality that it will dominate the noises peculiar to various industrial activities, and carry the sound far enough to meet the local needs. Further, the modeling of the horns is such that the signal may be either scattered or concentrated in a directional sense. Naturally, the horns for the more robust service are of greater power than the familiar automobile signal, and are wound for 110 or 220 volts, direct or alternating current, so that they can be connected to the establishment's lighting or power circuit.

In offices, where the prevailing bustle is of the temperate sort, electric gongs, bells, buzzers, air whistles, or incandescent lamps may suffice to convey the necessary signals. But, be this as it may, the primary mechanism is one by which the controlling impulses are sent over the wires and the especial call is sounded simultaneously throughout all parts of the plant—a steel mill, a shipyard, a textile factory, a printing establishment, the ramifications of a coal mine, a big construction job, a railway terminal, aboard a ship, or elsewhere.

WHEN you call up the office of a large company and ask for Mr. Blank, it is far too often the case that the switchboard girl is obliged to report: "Mr. Blank is not at his desk; I will try to find him." And when somebody calls one of your own executives, it far too often happens that your train of thought is completely wrecked by the tinkle of your instrument, and your operator's frenzied demand: "Is Mr. Dash with you?" The engineering laboratories of Cornell University have been put into motion to find a cure for these annoyances; and Mr. Skerrett tells us of the success which has met this search.—THE EDITOR.



The electrical searcher that finds the man who is wanted on the wire or in the front office


EXTERIOR POWER CIRCUIT
HORN OR BELL CONNECTIONS
LOCAL BATTERY CIRCUIT
RED LAMP
WHITE LAMP
ROTATING KNOB
INDEX HAND
CODE SIGNAL DIAL
MINOR CONTACT FINGERS
RELAY
CLOCK WORK FOR DRIVING CAM-SHAFT
WINDING AND OPERATING LEVER
RELAY CONTACTS WHICH BRING THE SIGNALLING CIRCUIT INTO PLAY
MASTER CAM WHICH ACTUATES THE MASTER CONTACT THUS CLOSING THE EXTERIOR SECONDARY CIRCUIT FOR DISTANT SIGNALS
CAM-SHAFT

Working details of the call system by means of which the telephone operator locates the missing member of the staff

As Professor Karapetoff says: "With such electric audible signals scattered throughout a plant, it becomes an easy matter to locate instantly any person to whom a code number has been assigned. For example, when the manager wishes to speak to one of the assistant superintendents, who may be anywhere on the premises, he simply tells the telephone operator to sound this particular man's call. As soon as the man desired hears his 'number,' he goes to the nearest telephone and reports his presence, whereupon the operator promptly connects him with the manager. It would be rather inconvenient for the telephone operator to sound the various calls by hand; therefore a special code-calling automatic instrument, the locator, has been developed for this purpose. The operator merely sets the desired person's code number by rotating an engraved dial and then pulls a little lever." The latter action sets going a contact-making mechanism, and the fingers so actuated by a multiple camshaft close the electric circuit and thus operate the different sound signals throughout the establishment. When this has been done the prescribed number of times, from one to three, then the distribution stops automatically.

In one large publishing house in New York City, the code-calling instrument is installed on the desk of a clerk in the production manager's office, the switchboard attendant having nothing to do with its operation. The use of the system is purposely limited to important calls and to the exchange of information agreeably to an arbitrary code arranged to that end. In this way, office boys and other subordinates are prevented from disturbing high-priced men on trifling pretexts. The clerk in charge of the locator first ascertains the reason for communication before setting the instrument in motion, and upon his judgment rests the responsibility of forwarding or refusing to dispatch the requested summons.

It is not necessary to elaborate upon the many possible applications of this ingenious system. A person of ordinary imagination can easily visualize divers fields of usefulness. The primary point is that lost motion may be avoided and time may be saved by thus insuring

(*Continued on page 174*)

Sugar from the Douglas Fir

A NEW and strange source for a rare variety of sugar has recently been discovered in the Douglas fir tree of British Columbia, upon the foliage of which is formed a sugar producing the rare trisoccharide, melezitose, in greater abundance than any other plant known today to scientists. This sugar was formerly obtained from a shrub growing in the Turkestan and Persia. Analysis shows the sugar obtained from the foliage of the Douglas fir to be almost fifty per cent of the trisaccharide. Of particular interest from a chemical and botanical point of view is the fact that analysis shows the sugar to be possessed of a high degree of constancy of composition. Dr. F. T. Shutt, Dominion Chemist at Ottawa, and two chemists at the Carbohydrate Laboratory of Chemistry, United States Department of Agriculture, at which latter place is a laboratory specially equipped for the examination of saccharine substances, both have investigated the fir manna, as it is called. A summary of the complete analysis makes it plain that the sample of the Douglas fir manna examined yielded about fifty per cent of pure crystaline melezitose. The figures are:

Melezitose	75.83%
Sucrose	2.9
Reducing sugar	11.5

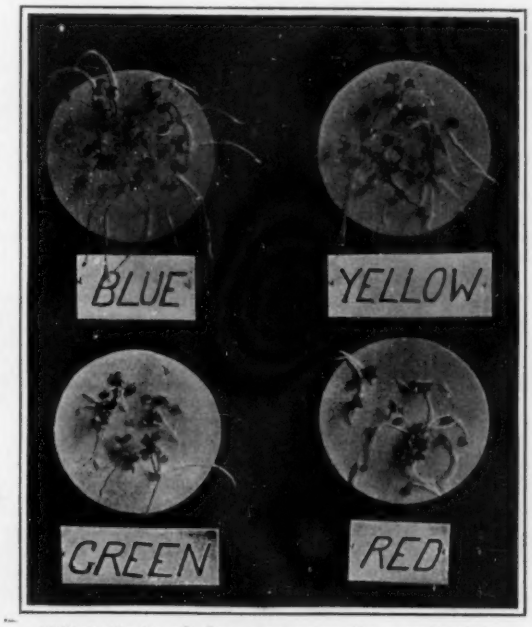
But there are more than mere dry figures to the story of the Douglas fir sugar. Though it has just recently been learned of by the white men and investigated by one of the leading botanists of British Columbia, Professor John Davidson, F.L.S., F.B.S.E., it now becomes known that long before the first white man ever set foot in the wilderness regions of North America the Indians of certain districts of British Columbia knew of this sugar, and gathered it for their own use. That they have been doing this since he came makes the fact more remarkable. To the average man it seems strange that so unusual a thing as sugar on a coniferous tree would not have attracted the attention of at least one of the many men who pioneered and travelled through the regions where it is found in the last hundred years. Yet so far as the writer can ascertain none of the early missionaries, surveyors and others made any mention of it.

The sugar fir is confined to the dry belt of British Columbia, and is chiefly found in the hottest parts of the interior of the province between parallels 50 and 51, and 121-122 longitude. These areas take in the Thompson River valley west of the mouth of the Nicola River; the district near the junction of the Fraser and Thompson Rivers at Lytton, and a part of the Fraser valley above Lillooet. In the Kamloops district, the Nicola valley, the Similkameen valley and in the eastern portion of the State of Washington it is also reported to occur.

Professor Davidson covered a great deal of ground in the dry-belt, investigating particularly the Botani valley, near the junction of the Fraser and Thompson Rivers. Upon first hearing of the sugar and before seeing it, he was inclined to believe the phenomenon was caused by the plant being attacked by insects, probably aphides, as the white masses of sugar

Branch of the Douglas fir, showing the formation of sugar

were scattered over the foliage and branchlets, while drops of small size appeared upon the leaves at the tips; sometimes two or three tips would be imbedded in a very large drop. He was at first the more inclined to think this formation was the efforts of the plant to repel attack from insects, probably aphides, by reason that the *tamarix mannifera*, when attacked by



Effect of colored glass screens on the germination of seeds

the coccus insect, yields a mucilagenous sugar—the manna of Mt. Sinai. This was at once dispelled, however, when he took up the actual investigation, for he found that the sugar appeared only upon those trees which were perfectly healthy and almost entirely free from insects.

A careful survey of the ground showed that upon trees standing on gentle slopes facing north and east in the dry belt and which were fairly wide spaced, such as is common in the dry belt where the fir is encroaching on other dry belt flora, the greatest abundance of sugar was found. Trees on fully exposed southern and western slopes, exposed to the full heat of the sun, did not generally show any sugar. Similarly, trees in the dense forests of the coastal region were

(*Continued on page 174*)

The giant panda or bear racoon

Our First Giant Panda

THERE has recently been placed on exhibition at the New York Museum of Natural History the only giant panda ever brought to this country. The skin was obtained from a missionary in western China, and is shown mounted in the accompanying illustration.

The giant panda, which in size and general shape resembles a bear, is in reality a distant relative of the racoon. It is sometimes called the bear-racoon. Its striking black-and-white coat and short muzzle, as well as the curious black patches about the eyes, give it a most extraordinary appearance. Very little is known regarding its habits, but it is said to feed on roots, vegetables and bamboo shoots. It is one of the rarest of animals, having been first discovered in 1869 in the mountains of Moupin, eastern Tibet, by the French missionary and explorer, Pere David.

Colored Glass for Seed Germination

SOME surprising results have been secured by growing seeds under sheets of colored glass. The plan is one which is easily followed by the gardner, for it simply consists of protecting the seeds with sheets of colored glass during germination, and for a few days after the little plants appear on the scene. Ordinary glass stained with the aniline varnishes, sold as hat dyes, answers the purpose very well indeed. Thus there is no need to go to the expense of getting real tinted glass.

Sheets of glass in the desired color are placed over the seed bed or the boxes and no other special treatment is required. It was found in an elaborate series of experiments that the seeds germinated better and grew into stronger plants sooner when they were under blue glass. The little plants shown in the photograph were given exactly the same treatment and just the same number of seeds were allotted in each case.—*S. Leonard Bastin.*

An Historical Mesquite Tree

IN Honolulu, Hawaii, on October 23, 1919, there was cut down a mesquite tree which for many years had served as a valuable source of seed and had been an historical landmark attracting the interest of thousands of tourists traversing the Pacific Ocean.

Originally introduced into Hawaii by Father Bachelot and planted in the Catholic Mission grounds on Fort Street, Honolulu, in December, 1828, this mesquite tree, *Prosopis juliflora*, or algaroba, the name by which it is known to the inhabitants of the Territory of Hawaii, has during the ninety-one years of its existence been the progenitor of thousands of trees which now cover throughout this island group approximately 90,000 acres of mostly stony, arid, and barren land which formerly was utterly worthless for almost any other purpose. From these algaroba forests today there is derived an annual yield of approximately 30,000 cords of excellent fuel wood, $160,000 worth of honey, and enormous quantities of beans which furnish a valuable fattening food for stock at a time when the long, dry summer has exhausted the grass supply.

The original tree, which has stood as an abiding monument in memory of the priest who introduced it, attained a diameter of 3 feet 3 inches and a height of probably 60 feet before it was severely topped in 1906 to make room for a new city block. With roots weakened by decay its permanence recently became uncertain and the demand for building space of greatly increased value made it necessary at last to do away with this old monarch.

The algaroba may truly be said to be the most valuable tree in Hawaii today for the offspring from this original tree are the chief support of the local wood dealer, a boon to stockmen, and the main standby of the apiarist.

The wood of the algaroba is a dark reddish brown

(*Continued on page 175*)

Original mesquite tree in Hawaii

Putting Flax on a Modern Basis

How an Industry That Has Always Been Conducted by Hand is Feeling the Touch of the Mechanical Engineer

THE cultivation of flax is the most ancient of all textile industries, having been carried on for some 3,000 years. Throughout that period, up to the present time, the slow laborious, hand-labor system of preparing the fiber for manufacture has continued practically unchanged, machinery not having heretofore entered and revolutionized this field as it has in the case of other agricultural commodities.

Thus, in a country where can be found vast crops of every description, flax has hardly gained a foothold, its culture is insignificant; whereas, according to one authority, "to meet the present requirements of about 10,000 tons of raw flax a year, the United States would need about 50,000 acres devoted to fiber raising. In fact, to raise the flax needed for our present raw material requirements, and, in addition, enough to manufacture at home our present imports of linen fabrics, would require about 400,000 acres devoted to fiber raising."

The great drawback to the farmer has been the laborious work of preparing the fiber for the mill. In such preparation there are some fourteen distinct processes necessary, starting with cultivating the land, and ending with binding and shipping the clean fiber to the mill, all these stages being hand work. Part of this labor, too, is of a disagreeable nature, more especially the retting (rotting) process whereby the woody and pulpy portions are removed to leave the cleaned fiber. Furthermore, the major part of this work requires high skill.

European conditions brought about by the war, are such that, it would seem, the present is a most opportune time for establishing a permanent flax-fiber industry in the United States. But this country, of all lands, must be approached and can be won only by a machine proposition and not by an all-hand-labor one. It is therefore of great timely interest to know that a London corporation has been working on this problem for the last ten years or more, during which time it has expended upwards of 80,000 pounds. It now claims that success has rewarded its untiring efforts, that it has the perfected, commercial machinery necessary to take the place of hand labor. These machines cover the essential stages of production, the pulling, deseeding, retting and scutching, in the order named.

A stand of flax after pulling, awaiting transportation to the deseeding machines

Under the old system, the first three processes require a degree of skilful labor, while the latter means skilled labor, pure and simple, pursued under conditions often very bad. The invention of a pulling machine and an automatic scutching machine are absolute essentials if flax is to be developed and carried on in any of the newer countries, such as Canada, America, etc.

The pulling machine must be so constructed as to pull *all* the flax; it must eliminate weeds, leaving them unpulled; it must deliver the straw straight and untangled.

Deseeding, the next stage, requires that all seeds be stripped off, leaving none on the stems or boughs; the seeds and stems must not be bruised; and, again, the straw must be delivered, straight and untangled. During a recent English test of the latest model deseeding machine, over five tons of straw (with seed on) were put through the machine in seven hours, the result showing but 2 per cent of waste (broken straw, leaves, dirt, etc.), and there was no lapping of straw around any part of the machine or its bearings, during the run. The machine actually delivers the straw straighter than it gets it. In a carefully prepared statement of costs, comparing hand and machine labor it was found that the latter's work would mean for a season a saving by machine work of over $2,000, in which latter time there would have been deseeded some 500 gross tons of straw. These figures are of course based on English labor.

Retting (or rotting of the straw after it has been pulled) is described as the most particular and the most decidedly disagreeable in the preparation of flax. Flax is a bast or inner-bark fiber. The commercial fibers run in strands between the pulpy outer skins of the stems and the wood pith forming the center of the stem; they are firmly bound in place by an intercellular gum, called pectose, and this gum has to be decomposed before the fiber can be freed for use. This retting process under old methods has been carried on by dew, pool and steam, thereby producing the necessary fermentation through moisture, but leaving the product during this period at the mercy of temperature, weather and the individual farmers. Dew retting consists in spreading the flax when pulled, either on the ground on which it has grown, or adjacent grass land, and leaving it exposed until sufficient fermentation has taken place with the aid of moisture in the air. Water retting consists in steeping the flax in water until the same effect has been produced.

The retting is the separating of the fibers as above indicated, and while it is less applicable to machinery than the other stages of flax preparation, it can be better done by tanks properly designed and constructed, one advantage of which is that the work can be carried on at any time of the year, another being the possibility of keeping the temperature at an even and necessary point. Tanks in which the flow and temperature are under control, are manifestly an advantage over work done in the open, subject to the uncertainties of

(*Continued on page 175*)

Above: The time-honored method of scutching by hand. *Left:* The scutching machine recently developed. *Right:* The machine that removes the seeds from the straw before retting and scutching

Old and new methods in the recovery of linen fiber from the flax

Left: The beaver house at the center of the dam, 40 feet broad and 16 feet high, with interior, 14 inches above the water level, large enough for a tall man to lie down. *Right:* A section of the big dam, looking upstream across the pond. *Below:* A beaver at work cutting down a large tree for the foundation of a dam.

The four-footed engineer and one of his record-breaking structures

A Beaver Dam of Huge Proportions

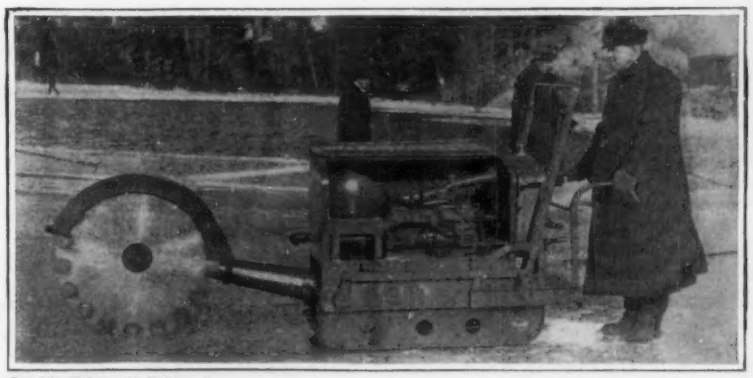
THE engineering feats of the beaver are a matter of familiar knowledge; but it will surprise many of us to know that a single colony of these industrious animals is capable of constructing a dam twelve feet high and a quarter of a mile long. Yet such a dam was recently discovered by a state game warden, in a secluded spot along Taylor's Creek, Bayfield County, Wis. Even the beaver house at the center of the dam is of elephantine proportions, being 16 feet high and 40 feet broad at the base. The sleeping apartment inside the house is exceptionally spacious for a beaver home, being large enough for a tall man to lie down at full length. The floor was found to be covered with a dry substance and was as clean as a whistle. Evidently the beavers were looking for a long winter as large quantities of food were found stored in the house for cold weather use. Nine beavers, an exceptionally large family, were living comfortably in the house —the parent beavers and their children.

Beavers are very like some humble, primitive race of people of peaceful disposition and few wants, industrious, and practical in their affairs, and apparently depending more upon reason and less upon instinct than do any of the forest folks. Many of their habits reflect so much of intelligence that some writers credit them with possessing real intelligence and many of their peculiar customs would seem to bear out this claim. But a careful study indicates that their acts, habits and customs are all instinctive, as they have in no way improved or advanced from their original customs since the discovery of the species. They build their dams and lodges, provide their food supply and pursue the same course as they did thousands of years ago, while if they were possessed of intelligence, they would certainly have made some advancement somewhere.

A Gasoline-Driven Saw for the Ice Harvesters

IN order to expedite the harvesting of natural ice, there has been introduced of late a gasoline-driven saw of the type shown on this page and on our cover. This saw consists of an automobile type power plant and a circular saw at the end of an adjustable arm, so that the saw can be raised and lowered to the desired degree. The saw is pushed along on steel runners, the operator behind furnishing the motive power. A double lever arrangement just over the handle bars serves to control the raising and lowering of the saw.

The portable saw in question cuts the ice into 20-foot squares. These squares are guided through the water to a gang of four circular saws, which cuts the squares into the regulation sized cakes.



Copyright, Underwood & Underwood

Gasoline-driven saw which makes short work of cutting natural ice into 20-foot squares

Copyright, Kadel & Herbert

Selling whale meat on the East Side of New York at 25 cents a pound

Whale Meat to the Rescue of H. C. L. Victims

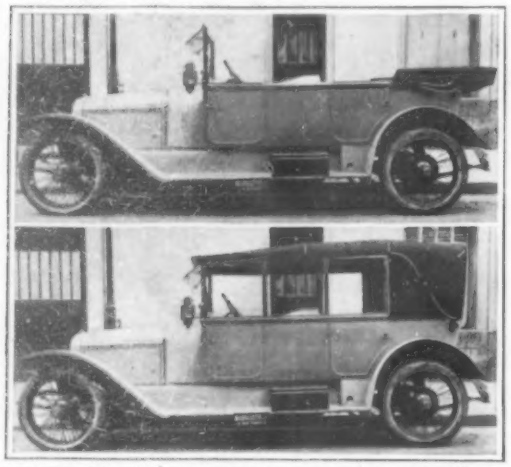
WE know that whale fisheries existed as early as 890 A. D., when Ohthere, a native of Heligoland, describes the course which the whale hunters used to travel along the coast of Norway. During the centuries which have elapsed the commercial products of these animals have continued to contribute to the comfort and welfare of mankind. Sperm oil was the most important and valuable of the whale products until about 1860, when petroleum and its products, as well as vegetable oils, displaced it from an economic point of view, and whalebone became the most important result of the fishery.

Whales and porpoises are warm-blooded animals and, therefore, their flesh is "meat," not fish. This meat resembles beef in texture and appearance, and venison in taste; but, nevertheless it has a distinctive flavor of its own. For some time it has held an important place in the dietary of the Japanese, and is rapidly growing in favor in Norway, the United States, and other countries. It may be marketed fresh, frozen, corned, or canned. It is cut from the whale in chunks, looking something like a rough hewn joist. These chunks are in turn cut into smaller strips, chilled, and packed in boxes for shipping. As it contains no bone or gristle there is no waste. A chemical analysis of canned whale meat shows that it contains about thirty per cent protein, over six per cent of fat, and less than two per cent of ash. It also contains a certain amount of oil, the taste of which can be overcome by soaking the meat in boiling water and soda before cooking, or by parboiling. The humpback whale is probably the best species for eating, and about six tons of edible meat may be obtained from each animal; which is not so much when it is considered that the largest of the whales, the blue whale, reaches a length of 87 feet or more and has an estimated weight of 75 tons. A calf was 25 feet long at birth and weighed about 8 tons. Their diet is fish and crustaceans, therefore, they may be considered as a cleanly animal and proper to be eaten.

In 1918, 30,000 cases of the meat were canned and 195 tons were frozen for market by the West-Coast whaling companies, and this was entirely inadequate to supply the demand. Equipment has now been provided for 50,000 cases of canned meat and 1,000 tons of frozen meat. We may now look for a renewal of Maine whale fishery and Texas has now been aroused by the use of the meat of porpoises, which are really small whales. Whale meat is now sold regularly in New York at twenty-five cents a pound, and may be cooked by any of the recipes which the Government has collected.—*A. A. Hopkins.*

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts



A convertible body as a touring car and as a closed car

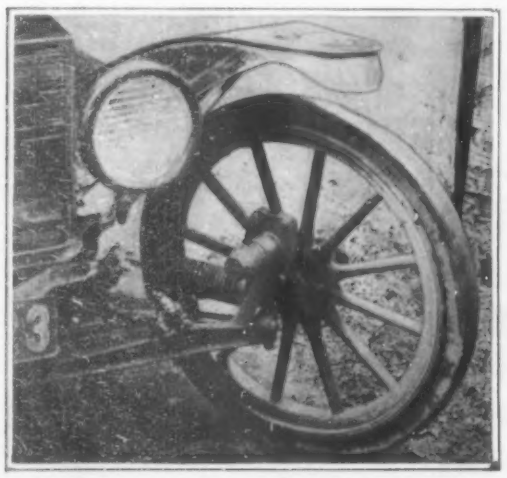
An Ingenious Convertible Body

WITH the presence of cold weather there is a growing realization of the advantages of the convertible touring body which can be used as an open or a closed car at will, the conversion being effected by the driver without much trouble. It is not difficult to attain this end by the use of a permanent top body and sliding glass windows, but these have the defect, in the eyes of some people, that prevent their universal use because the top must always remain raised, cutting off considerable fresh air that can be obtained with a folding top job.

A neat automobile body of French design is shown herewith, this being a folding top job that is quickly changed to a closed car by raising the top, which is similar to an American "one-man" pattern in design, and then sliding the windows in place from the compartments in the body sides and doors till they reach the top side rail, where they are attached. The body is very neat in appearance either as an open or closed job and is said to be exceptionally light for a combination body of this type.

A Spring-Controlled Wheel Link

REV. HUGH EWING of Columbus, Ohio, is the inventor of a spring-controlled vehicle-wheel link for either automobiles or wagons which is designed to take up shocks when the wheel encounters obstructions, without communicating the shocks through the body of the vehicle. It is claimed that it greatly surpasses the pneumatic tire in efficiency and thus makes possible the use of hard rubber cushion tires on automobiles at a great saving in upkeep, and the elimination of tire troubles which are the principal source of delay and derangement of plans, to say nothing of the expense for repairs to the car-owner.



This spring-controlled wheel link takes up the jars of the wheel

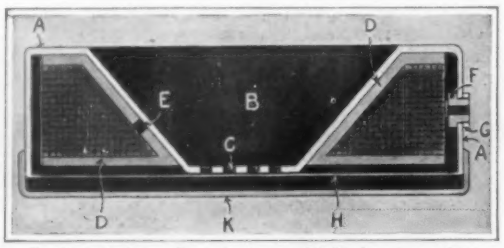
As will be noted in the accompanying illustration a supporting link for the body of the vehicle is carried upon the wheel axle. This link is pivoted approximately vertically over the wheel axle. A main spring normally keeps this link in its vertical position. A stop limits the rearward swing of the link to substantially 45 degrees. When checked at 45 degrees, the spring sustains only half the weight of the vehicle, the balance being carried by the link. This arrangement makes possible the use of a relatively light and sensitive spring, which greatly increases the resilient action of the device and takes up all the jounces encountered by the wheels.

An advantage of this invention is that the weight of the vehicle rests for most of the time on the vertical links and the springs are normally free from pressure and act with the greatest freedom. When the wheel encounters an obstruction, it is checked momentarily in its forward movement, but by reason of the swinging link the vehicle body continues forward unchecked, and without appreciable jar, while the wheel rises over the obstruction without lifting the vehicle body, as the springs take up the displacement between it and the body of the vehicle. Large obstructions can be crossed without the least perceptible raising of the axle by the impact.

A Telephone Receiver That Is Different

THERE is little difference between the telephone receivers of the present days and those used by Bell in the pioneer days of the commercial telephone. Yet it appears perfectly obvious that the present type of telephone receiver offers a fruitful field for the experimenter and inventor who would depart from the conventional and strike out along new lines.

An inventor named H. E. Parry of London, England, has recently patented a telephone receiver which represents an attempt to depart from the present type. His receiver, which is shown in the accompanying sectional view, consists of annular magnetic casing *A*, having a conical central part *B* which is perforated at *C*, the central part forming the pole piece and acting on diaphragm *H*. *D* carries the magnetizing coil, one end of the coil being led through a hole *E*. The case *D* with the winding is pressed into the casing *A* under sufficient pressure to cause it to be held in place without further attachment. When the case *D* is in place the wire which extends through the hole *E* makes contact with the casing *A*. A hole is made in the casing, in which is a socket *F* of insulating material to the outer part of which is attached the ring *G*. The other end of the winding is passed through this socket *F* and is secured to the ring *G* of insulating material. A diaphragm *H* is secured to the casing *A* by the non-magnetic metal cover *K*, the cover making such a fit with the casing *A* that the diaphragm *H* is secured without further attachment.



Sectional view of a new type of telephone receiver

An Electric Arm for the Autoist

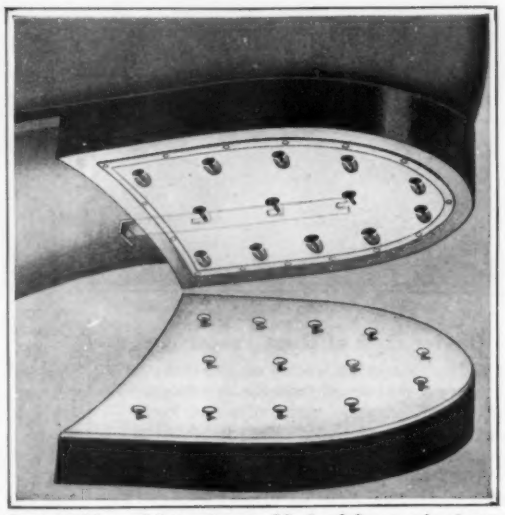
AN automobile turning signal that gives intermittent flashes at night, compelling the attention of other motorists, has just been devised by a San Francisco inventor.

The trouble with so many signals is that they fail to attract the attention of the motorist ahead or behind the car that may be operating a signal. But this signal about to be described gives intermittent flashes, which quickly catches the eye of the driver in the rear.

The flashes are produced by an electric light attached to the end of an arm, with two revolving disks, the light being located between the two disks which start to revolve as soon as the arm is moved into the position for indicating to a driver following, that a turn or a stop is about to be made.

The intermittent flashes do not indicate that the car is going to turn to the right or left or to stop, but merely call the attention of the drivers of other cars that a change is about to be made. The nature of the turn that is to be made by the driver is indicated by the position of the arm. Normally the arm is held in an upright position, and when the driver desires to turn to the left, he operates a lever which brings the arm to a certain position. When he is to turn to the right, the arm is moved to the second position, and when a stop is to be made the arm is moved down to a third position.

When the arm is in the upright position the light on the arm is extinguished, but as soon as the arm is moved down to any of the three positions, the light automatically comes on, and the action of the air causes the disks to revolve rapidly, thereby giving the intermittent flashes which attract immediate attention to the arm.—*C. W. Geiger.*



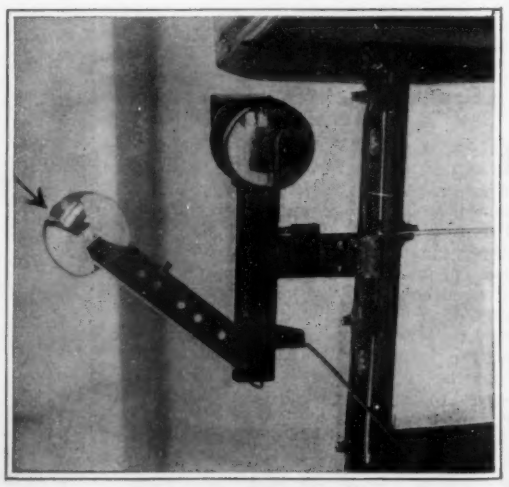
Detachable and interchangeable heel for men's shoes

Detachable and Interchangeable Heels

A SIMPLE but nevertheless ingenious invention now places the shoe on the same basis as the automobile as far as mechanical convenience is concerned. In other words, just as the tire of an automobile wheel can be readily removed and replaced, so can the heel of a shoe be removed with a minimum of effort and, what is more, without tools of any kind.

It has remained for Maurice Mayorowitz of New York City to invent what appears to be a practicable de-

(*Continued on page 176*)



This arm, with its revolving-light shutters, is bound to be seen by the man behind

Wisconsin
CONSISTENT

Slightly Higher in Price-But Consistent in Performance

TO reduce the price of Wisconsin Motors would mean the sacrifice of virtues that have made them marvels of skilled engineering and workmanship.

Every Wisconsin engine is so carefully fitted, adjusted and run-in that it will operate for months without attention. But this is not enough. To insure, absolutely, mechanical correctness in every detail, it is then torn down and the whole process repeated before it leaves our shop.

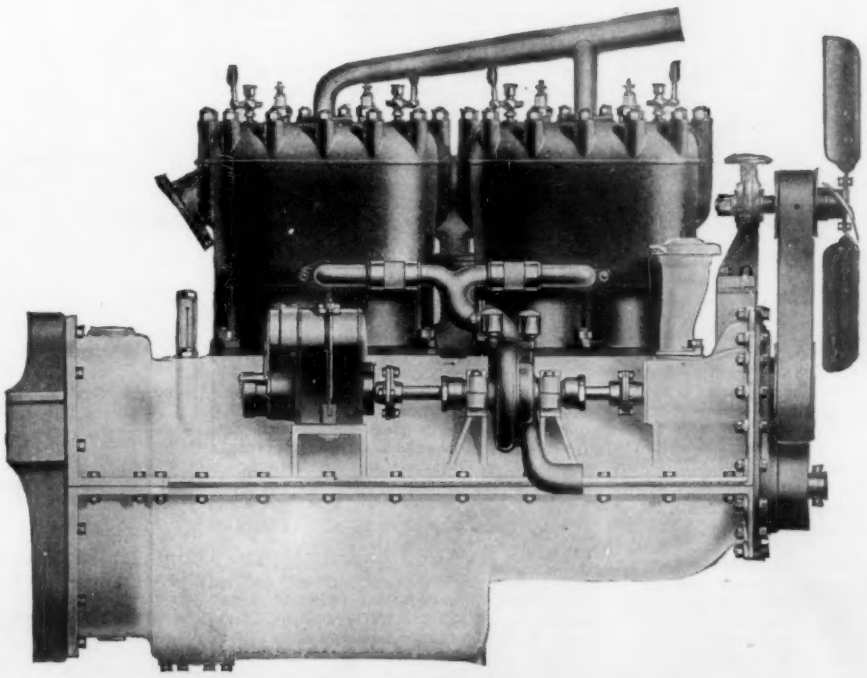
To reduce the price would mean elimination of these safeguards that motorists everywhere recognize as necessary in the production of a dependable, repair-eliminating, consistent performing motor.

The Wisconsin reaches its purchaser ready to run; it can be put to work immediately, and its performance will more than justify its slightly higher price.

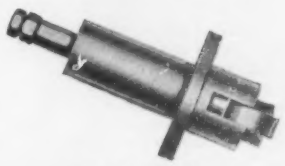
SPECIFICATIONS ON REQUEST

WISCONSIN MOTOR MFG. CO.
STA. A, DEPT. 352 MILWAUKEE, WIS.

DISTRIBUTORS:
New York Branch: T. M. Fenner, Factory Representative
21 Park Row, New York, N.Y.
California Distributor: Earl P. Cooper Co., Los Angeles, Cal.
Northwest Distributor: Chandler-Dunlap Co., Seattle, Wash.



Workmanship that Makes Wisconsin Motors Worth More



Push Rods

Roller type, hardened steel, large diameter and bored out for lightness. Provided with case hardened adjusting screws. Complete assembly can be removed without disturbing other parts.

Bearings

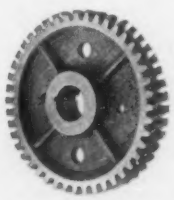
Wisconsin bearings are extra large. Made of Fahrig metal, backed with bronze. After being reamed and scraped to a fit they are assembled, run-in and then taken down to make sure that they have a 100% bearing face.

Valves

Wisconsin inlet valves are of chrome nickel steel and the exhaust valves are of tungsten steel. Valve springs are easily removed. Guides are extra long.

Connecting Rod

Connecting rods are of I-beam section type, drop forged of 35% carbon steel and fitted with babbit-lined bronze bushings on the crank shaft-end and bronze bushings on the wrist-pin ends.



Timing Gear

Timing gears are helically cut and have wide faces. This gives strength, as all the strain never comes on a single tooth. Gears are very rigidly mounted and are lubricated by a separate lead inside.

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Aeronautics

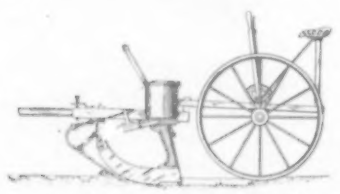
AIRPLANE LANDING PLATFORM.—T. J. CAHILL, 238 N. 12th St., Philadelphia, Pa. The invention has for an object the provision of a landing surface with means for checking the progress of the airplane during the landing operation. A more general object is the arrangement of the platform and checking device which may be positioned in crowded sections of cities so as to provide a landing at any point desired, and thus obviate the necessity of maintaining aviation fields at points remote from the business sections of large cities.

Electrical Devices

ELECTRIC VIBRATOR FOR RETOUCHING IMPLEMENTS.—W. PUTKOWSKI, 74 Newark Ave., Jersey City, N. J. The invention relates to an electric vibrator for retouching devices such as are used by photographers in the retouching of photographic negatives. The invention has for an object the provision of an electrical construction which will properly operate a vibrator for a retouching implement and will cause the same to vibrate without any appreciable noise.

Of Interest to Farmers

PLANTER ATTACHMENT.—F. I. CLASSON, R. No. 3, Ottawa, Ill. This invention relates to planter attachments and one of the principal objects is to provide a means for evening and smoothing irregularities in the surface of the ground due to the tracks made by the



A SIDE ELEVATION OF A CORN-PLANTER EQUIPPED WITH THE DEVICE

horses or to uneven harrowing and thereby allowing the drill to deposit the seed at a uniform depth beneath the surface. The device is characterized by its simplicity, durability and economy in manufacture and maintenance.

TRACTOR PLOW.—C. M. DODSON, R. No. 1, Kirksville, Mo. One of the principal objects of the invention is to provide a plow of the tractor type, in which the plow points are arranged before and behind the single drive wheel in such manner as to place practically all the load on the drive wheel, whereby to relieve the plow frame of strain, and to provide means for shifting the weight both longitudinally and laterally.

FORE TRUCK.—J. C. HAYNES, Mountpleasant, Tenn. The invention particularly relates to fore trucks used in connection with wheeled scrapers, and other animal drawn wheeled appliances; the object is to provide a simple and efficient device whereby undue strain will be taken off the draft animals' neck and shoulders, and also permit short turning on all conditions of land.

SIPHON.—N. M. CHANDLER, Woodland, Cal. The invention has for its object to provide a device especially designed for use in transferring water from irrigating ditches to the fields, wherein a flexible tube is connected with the delivery end of the siphon having a greater cross sectional area at its outlet than at its inlet, to decrease the velocity of the water and to spread the discharge in a flat sheet parallel with the ground and thereby reduce the corroding effect of the water upon the land.

COTTON CHOPPER.—R. L. INGRAM, Silesville, N. C. This invention relates to choppers adapted for use in chopping out superfluous plants in the cotton drills and reducing the same to stands. The object is to provide a simple and durable device, in which a suitable number of chopping hoes may be used spaced apart, the machine being moved in line with the drills, so that the chopping hoes are carried to chop out and destroy the superfluous plants and reduce them to stands suitably spaced apart.

ROAD SURFACER.—P. V. ADKINS, 620 Osage St., Leavenworth, Kan. The object of the invention is to provide a machine for use in keeping up the grade of earth roads or streets, and the leveling down of high spots therein, as well as for filling up the ruts made by vehicles; more particularly the invention relates to a machine involving a wheeled frame having generally the shape of a xalene triangle and employing an obliquely disposed transverse scraper blade.

Of General Interest

PAPER TEARING DEVICE.—A. C. KUNDTSON, 510 Broadway, Bismarck, N. Dak. The invention relates to paper dispensing devices and particularly to a paper tearing device for rolls of paper. The purpose of the invention is to provide a device having means for permitting the unrestricted dispensing of paper from a roll and for locking the paper against further feeding when tearing the same so that the paper may be always cut with a straight edge.

PROCESS AND APPARATUS FOR PRECIPITATING MATTER FROM GASES.—W. W. STRONG, 500 So. York St., Mechanicsburg, Pa. An object of the invention is to provide a process by means of which poisonous fumes, smoke, or other matter suspended in the air, or light gaseous body, may be precipitated and removed from the air, or other gaseous body. A further object is to provide an electrical device for removing the suspended particles of matter by ionizing or electrifying the particles, this ionizing device to be used in connection with an absorbent, such as charcoal or the like.

RECOIL PAD.—F. D. HAWKINS, Miethele, So. Dak. The invention has for its object to provide a pad of the character specified, adapted to be attached to the stock of a gun, to absorb the shock of the explosion, wherein the arrangement is such that the elements of the pad in absorbing shock, move directly towards each other and parallel with the axis of the gun, instead of laterally.

SMOKESTACK.—J. J. REILLY, c/o N. H. Malia, 392 Clinton Ave., Brooklyn, N. Y. The object of the invention is to provide a smokestack which will collect soot and dust and deposit them in a receptacle without materially interfering with the draft of the furnace. The device provides a casing in which the stack is disposed, spaced from the stack to form a passage. The upper end of the casing is inclosed upwardly and inwardly. The bottom of passage is closed by an inclined head, the lower end of which forms a chute leading to a receptacle to collect the soot and dust.

FOUNTAIN PEN.—G. T. BYERS, 68 Barclay St., Nyack, N. Y. The invention relates to that type of fountain pen including an ink-containing sack, and deals particularly with means for deflating the sack when it is desired to charge the same with ink. The invention has for its general object to provide a device so designed that the presser bar can be actuated by a slide movably mounted in a slot in the barrel of the pen; by a slight movement of the slide the pressure bar will be actuated to deflate the sack.

MANICURE IMPLEMENTS.—J. O. LANDIS, 1231 Wyoming Ave., Philadelphia, Pa. This invention relates to a manicuring implement and pertains more particularly to a device especially adapted for trimming the nails. A further object is to provide a device of this character in which the cutting edge may from time to time be renewed, and which in its initial manufacture is both simple and cheap.

DISPLAY BOX.—C. E. HARRIS, 135 So. Oxford St., Brooklyn, N. Y. The invention has reference more particularly to an independent support adapted to form part of the box and by means of which the merchandise in the box may be presented in a convenient form for display. An object is to provide a display box in which the support for displaying the box and its contents is provided with means for locking the box to the support when the box is either displayed or transported.

SCORE BOARD.—C. E. BUCKLEY, 503 W. Washington St., Champaign, Ill. The object of the invention is to provide a score board especially adapted for scoring progressive five hundred, wherein the board is provided with a scoring scale, and with openings arranged in a predetermined manner and bearing value indicating legends, together with a series of pegs for engaging the openings to indicate by their positions the table at which the player is playing and the total score whether plus or minus.

BAG.—B. G. ALLINGER, Quincy, Ohio. The invention relates to containers, and more particularly to bags for containing granular or pulverulent material; an object is to provide a bag that may be filled and closed more readily than by the usual method of tying or pasting. Another object is to provide a bag on which the contents may be indicated and advertising matter displayed.

DETERGENT.—S. WALD, 502 E. 77th St., New York, N. Y. Among the objects of the invention is to provide a detergent calculated especially for the washing or cleaning of clothing. More specifically stated, the invention has reference to the compounding of a detergent comprising several ingredients of a relatively strong character, associated with other ingredients having the facility to render them safe in use but without detracting materially from their efficiency as dirt and grease destroyers. The ingredients are as follows: Russia blue, .10; soda peroxide, .90; soda ash, 1.00, chlorid of lime, 4.00; borax, 4.00; pulverized soap, 5.00; potassium carbonate, 5.00; ammonium carbonate, 20.00; lye, 60.00.

SNAP.—S. HIRSCH, 920 Longwood Ave., Bronx, N. Y. The object of the invention is to provide means for securing together the two ends of a chain, such as a lavilliere, or conveniently securing together the ends of a cord adapted to receive beads, pearls, etc. The invention aims to provide a snap in which the grasped portion may be inserted in the grasping portion in any manner desired, which shall be ornamental, and so simple as to prohibit any danger of breakage occurring.

UMBRELLA SAFETY DEVICE.—H. LAWSON, 800 E. 179th St., Bronx, N. Y. Among the objects of the invention is to provide a safety stop adapted to be positioned upon the upper portion of the umbrella stem, to prevent the umbrella from being turned inside out when used in high winds. Another object is to provide a stop adapted to be positioned on the main umbrella rod to limit the movement of the sliding collar and to further function as a stop or support with which the bracing ribs may directly contact.

SANITARY SUGAR BOWL.—Q. GILETTI, c/o Sossi, 340 W. 26th St., New York, N. Y. The object of the invention is to provide a sanitary sugar bowl arranged to normally hold the cover of the bowl in closed position to prevent flies, dust and other extraneous matter from reaching the sugar. Another object is to permit a person to readily open the cover for access to the sugar and to automatically close the cover on lifting the bowl off the table, or support.

PROCESS FOR THE MANUFACTURE OF MAGNESIA.—E. E. DUTT, Jabalpur, British India. The object of this invention is to manufacture magnesia from substances containig a magnesium compound together with various other substances, among the principal of which may be mentioned the compounds of calcium. To carry out the process the substance containing magnesium is dissolved in hydrochloric acid, and a solution of magnesium and other chlorids is thereby obtained.

FLAG HOLDER.—H. M. SIEMANN, Fort Lupton, Col. The invention relates particularly to self-supporting holders for flags and devices of like nature, which may be mounted on any suitable support capable of engagement by the holder, the object being the provision of an inexpensive device which may be readily constructed of a single section of wire and an addition to its flag supporting portion will include a clasping portion for engagement with any suitable support.

DOUBLE-EXPOSURE PREVENTER FOR CAMERAS.—W. H. TOUCHETTE, Burlington, Vt. The object of the invention is to provide an attachment to the shutter-actuating mechanism of a camera, whereby accidental double-exposure of a film or plate is prevented. A further object is to provide means for preventing successive operations of the shutter mechanism until the film spool has been operated to properly position an unexposed film.

COUCH LEG FASTENER.—N. F. SPENCER, Vallejo, Cal. The invention has for its object to provide a device for permitting couches to be shipped with the legs detached, and to be set up by unskilled labor when the couch reaches its destination. A fastener of sheet metal is provided and is composed of sides extending at a right angle and flaps extending at a right angle to the sides; the keeper thus formed is provided with upwardly pointed lugs to be pressed into the square portion of the leg to prevent accidental detachment.

Hardware and Tools

WRENCH.—H. D. SEITZMAN, 2124 63rd St., Brooklyn, N. Y. An object of the invention is to provide a wrench having means for adjusting and holding the movable jaw so that when once adjusted the jaws will not slip but will securely hold the nut or pipe with which they are engaged. A further object is to provide a wrench which may be used in connection with any form or shape of nut, bolt head, or pipe, and which will efficiently perform its functions in all cases.

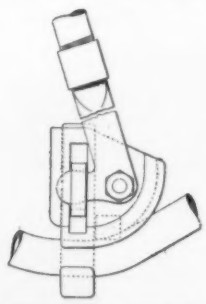
CASE FASTENER.—J. W. KAUFMANN, 1730 N. Monroe St., Baltimore, Md. The invention has for its object to provide a fastener of the character specified especially adapted for suitcases, brief cases and cases of any character wherein a simple, inexpensive fastener is required, having means in connection therewith for holding the sections of the case frame from gaping open when the catches are released until the lock is unfastened.

SCREW DRIVER.—J. SONTHEIMER, Route No. 5, Lincoln, Neb. The invention relates especially to a screw driver involving an insertible blade. Among the objects are to provide a relation between the blade and holder as to so position the front of the blade that the front end of the holder will bear against the screw in the operation of the tool, whereby to minimize the possibility of the screw driver slipping from the screw, and to provide a blade that may be reversed in the holder, whereby adapting the tool to screws of various sizes.

NUT.—J. N. B. WILSON, 4180 West Belle St., St. Louis, Mo. This invention relates to bolts and nuts for fastening rails or various machine parts, and more particularly relates to devices of the type in which provision is made for preventing the bolt from turning relative to the fastening elements as well as means for preventing turning of the nut on the bolt. An object is to provide a nut and locking means therefor, and bolt-locking means, as well as means to engage and fasten both of the locking means, and to provide for oiling of the nut and bolt threads.

POCKET SCALE HOLDER.—N. N. LUKIANOFF, c/o Automatic Machine & Tool Co., 87 Franklin St., New York, N. Y. An object of the invention is to provide a device which may be made of a single piece of material and preferably stamped out to produce a finished article. A further object is the provision of a scale holder which may be so constructed that it may be firmly, although removably, retained in any pocket of the user and consequently retain an object such as a rule or scale within the pocket.

BENDING TOOL.—R. M. HAWES, 191 Fairview Ave., Jersey City, N. J. This invention relates to a pipe or rod bending device; its object is to provide a construction which is in the nature of a tool so that it may be



A SIDE VIEW OF THE BENDING TOOL AS INVENTED

carried from one place to another and operated to bend a rod or pipe whenever desired; the parts are so arranged that the bending action will also act as a gripping action so that the tool will not slip at any time during its operation.

EMBROIDERY NEEDLE.—R. L. JEWETT, Gulfport, Miss. The invention relates to embroidery needles, particularly to those adapted for use in making imitation French knots; it has for its object the provision of which is so constructed that it may be quickly and easily threaded, the needle proper is provided with a

(*Continued on page 172*)

PATENTS

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Dredges of Other Days

(*Continued from page 155*)

nate bucket was removed and steel cutters were attached in their places. The theory that the buckets would easily take up the material loosened by the preceding cutters did not seem to work out satisfactorily, the result being a series of jolts which the engine could not safely endure. This plan was consequently abandoned. Note the analogy between this cutter idea, and the revolving cutters on our modern hydraulic dredges.

During the first half of the 19th century the steam ladder-dredge was perhaps the type most in use, both in America and Europe, although dredging with horsepower was still being done in this country as late as 1833, as shown by an article in the *Mechanics Magazine* of that year, describing and praising a new machine operated by a span of horses, and used on the Erie Canal.

It appears that at least two steam ladder-dredges were employed in the construction of the Delaware and Raritan Canal, 1830 to 1834, and in 1831 a steam dredge was employed on the Hudson River below Albany, which was presumably of the ladder type. The first steam dipper-dredge of the modern type was patented in 1845 by Oliver Allen of Norwich, Conn., and Morris & Cummings built the first dredge of the grab-bucket type in 1868, using it on the Hudson River. The hydraulic dredge was invented in France in 1867, and was introduced in this country in 1872.

Building to Burn

(*Continued from page 159*)

1910 there were 215 fires due to shingle roofs, and in 1918 there were 757 fires due to this sort of construction. 1919 promises to far eclipse all records as during the first three months it was found that 512 blazes of a destructive nature were traced to the wooden roof.

The menace of the wooden shingle has been felt in many places and today 91 large cities have anti-shingle ordinances. In no other field is it more profitable to take time by the forelock or to substitute an ounce of prevention for a pound of cure.—*Harry Botsford.*

On River and Canal

(*Continued from page 159*)

a molded beam of 20 feet, and a depth of 12 feet. On a 9-foot draft the craft will carry 550 tons of cargo.

Despite the fact that New York State has spent more than $150,000,000 in the modernizing of its Barge Canal system there has been comparatively little done by private enterprise to call into being a barge fleet of commensurate size or of types of vessels fit to make the most of these vastly important arteries of transportation. It has been authoritatively said that these canals are capable of transporting fully 10,000,000 tons of freight during an open season of 7 months, and it is to be hoped that the Government's example will stimulate the fullest utilization of the system.

The Federal Government has already opened a navigable channel linking the Great Lakes at Chicago with the Mississippi River. Extensive progress has been made in the canalization of the Ohio River. Important improvements have been carried out on the channel between St. Louis and Minneapolis, and the Missouri River is now navigable for the better part of the year as far west as Kansas City. A channel 8 feet deep now exists between St. Louis and New Orleans; and not long ago New Orleans started the construction of an industrial and navigation canal in connection with an inner harbor, which will bring the Mississippi River and Lake Pontchartrain together.

As has been said, speaking of the navigable highways throughout the Mississippi Valley territory: "This system of waterways, the greatest in the world—embracing 16,000 miles of navigable rivers—would not only entirely solve the

Here is the ordinary braided cable covering. Note the open and porous construction, easily cut, stretched or unraveled. Compare it in detail with Duracord.
This is Duracord. Thick, heavy strands, woven like a piece of fire hose, not braided. Picture shows outside covering with impregnating compound removed.
You judge its strength
THE outside covering of a portable cable gives it its mechanical strength. Underwriters demand that the electrical strength, the copper and the insulation meet their requirements—but you must decide whether the covering makes the cord as strong as it should be where the wear comes—on the outside. You must decide between braided covering and woven covering. Economy demands the decision.
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future transportation problem of this important area of our country, but it would tend to relieve the congestion of the railways of the entire United States." This is not a fanciful assumption, because the figures show that the Mississippi basin contains 70 per cent of our farms, produces 76 per cent of our wheat, 72 per cent of our livestock, 85 per cent of our corn, 55 per cent of our wool, 70 per cent of our cotton, 94 per cent of our iron ore, 47 per cent of our lumber, 69 per cent of our petroleum, and 60 per cent of our bituminous coal.

The Romance of Invention—VIII

(Continued from page 160)

jacket or casing inside of which is a radiator of aluminum fins. The barrel mouthpiece is so shaped that the gases of explosion, as they pass out of the gun barrel, exert a sucking action upon the air and cause a current of air (continuous in the case of continuous or automatic firing) to flow through the radiator, thus cooling off the gun. It is interesting to note in passing that the cooling system "pays for itself" not only in permitting sustained fire by carrying off the great heat developed, but by actually adding to the power of the gun. It has been found by test that bullets propelled through the barrel of a Lewis gun have a greater velocity than those projected by the same charge through the barrel of an uncooled gun of the same length, the reason being found in the fact that the draft of air prolongs the pressure of the gases upon the projectile. The gain is greater than the loss caused by diverting a small portion of the gases through a port in the barrel for the operation of the gun.

The Lewis gun is fed from magazines, not from belts. These are of steel and hold forty-seven rounds each, and can be changed with lightning-like rapidity. The gun itself has but nine moving parts. These are operated (in automatic firing) by diverting a small amount of the gases of explosion through a gas port four inches from the muzzle. This diverted gas-stream is led into a "regulator" where any sediment is deposited and finally into a cylinder where it impinges upon a piston, driving it back, winding up a spring. This spring operates the mechanism of the gun, revolving and stopping the magazine, moving the cartridge into firing position, ejecting the spent cartridge and firing the new one. It is the diverted gas from the second shot which winds up the spring ready to operate the gun for the third shot, and so on.

In passing it may be of interest to say a word about "jamming." Particularly in airplanes is the "jamming" of a machine gun dangerous, because there is so little time to rectify the trouble. Asked as to this matter Col. Lewis gave a very illuminating answer.

"All machine guns break, at times, and all machine guns jam," he said. "There was never a machine gun made of which some part would not break sometime if you used it long enough. The best machine gun, other things being equal, is that one which has its breaking point reached after the wear on the gun barrel has become so great that it is no longer of service. But a break, while it will cause a jam, is not by any means the only cause of a jam. A jam is the result of any cause within the gun which stops fire. In the vast majority of cases it comes from faulty ammunition, faulty either from error in manufacture or from damage done it before it went into the gun. If ammunition is too large or too small or bent or dented it may cause a jam, exactly as a faulty cartridge may jam in a single shot rifle. When you consider the extreme rapidity with which an automatic rifle may be fired, the wonder is not that it jams sometimes but that it doesn't jam more often than it does. It is never possible to jam a Lewis gun by a mistake in assembly because it is not possible to put a Lewis gun together wrong. Machine gunners are taught to assemble a Lewis gun blindfolded, by the sense of touch, and no two parts are so alike that they can be mistaken the one for the other."

During his long career in the army, Col. Lewis demonstrated that it is possible to be an officer and an individual at the same time. On numberless occasions he has been summoned before Congress and interrogated as to conditions affecting the service, and his straight-from-the-shoulder answers, if they frequently shed needed light on the matters which required illumination, and eventually brought reforms, were frequently so vigorous and outspoken as to earn for him considerable animosity from those responsible for the conditions of which he spoke.

Born in 1858, graduated from West Point in 1884, and serving continuously as an officer of artillery until he retired in 1913, Col. Lewis has seen this country grow up, in a military sense, and has the satisfaction of knowing that "the stormy petrel of the Ordance Bureau" as he has been called, has not beaten his wings against the bars of red tape and officialdom in vain. Many of his inventions (all presented to the government absolutely and without any question of any payment or any royalties) are in use today. It was his official report on the obsolete and inefficient ordnance equipment supplied the army in the Phillipines, which drew the Secretary of War's attention to needed reforms there during the war with Spain. Col. Lewis must look with satisfaction on subsequent history, for it records the fact that when Root later brought the matter to the attention of Congress he turned to Col. Lewis for a plan for a modern corps organization of artillery, which plan with but few minor changes was adopted and became law.

It was because of a confidential report of an investigation Col. Lewis made abroad that a complete rearmament of the field artillery of the United States was effected, modern quick firing guns on long recoil cartridge being adopted.

In addition to his many honors, this inventor has received the Elliot Cresson gold medal for his contributions to small arm manufacture.

Col. Lewis has at times been a target for criticism because he took his gun abroad, and there established factories for it. There is no other answer needed than the following facts, which are indisputable and undisputed:

1. When he invented and perfected his gun, still in the service of the United States, he made repeated efforts to give it to the government, which would have none of it.

2. He took it abroad and demonstrated its efficiency and practicability only after his retirement from the army and only after he had given up hope of getting it adopted by the United States.

3. He never did wish it adopted by the United States because he desired to make money out of it . . . his many inventions, always given, never sold, to the government should be sufficient proof of this. But if not, the fact that, when the United States entered the war and began to order machine guns of all types, regardless of their previous adoption by the War Department, he turned back to the Treasury over a million dollars in royalties on his gun sold to the nation, certainly does prove it.

4. The use of hundreds of thousands of the Lewis gun on the battlefields of Europe, where it competed with the best guns of both American and European manufacture is sufficient proof of the value of the arm.

Col. Lewis's experience, which is by no means unique, may well be a sufficient groundwork for the question asked by many inventors, as to why the United States has no more encouragement to give to those Americans who evolve the new and useful improvements of pro-

RECENTLY PATENTED INVENTIONS

(Continued from page 170)

longitudinally extending slot which gradually decreases in size towards the point, yet is of sufficient size to permit the thread to be passed through upon longitudinal movement into the bore of the needle.

DOOR BOLT.—E. BRADSHAW, 881 Ashby St., San Francisco, Cal. The invention has for its object to provide a device of the character specified for positively locking the door from the inside in such manner that it cannot be opened from the outside by boring or cutting the door, which is normally spring-held in operative position and which may be locked in operative position.

PIVOT HINGE.—J. Z. HANSON, 237 W. 13th St., Fort Worth, Texas. The invention relates to pivot hinges and associate parts used with lids and containers. The object is to provide a pivot hinge which may be easily operated for normally holding the lid of a can in place and permitting the easy movement thereof to one side so as to uncover the can. Another object is to provide a hinge which will, when operated, first raise the lid and then turn the same to an open position.

RIM TOOL.—H. RUSH, Chinook, Mont. The object of the invention is to provide a tool for straightening tire rims of automobiles which have become bent in use. The tool consists of a handle and a head, the head having a flat face to form a driving surface, and having in the face opposite the driving surface a slot forming upper and lower jaws, the lower jaw extending slightly beyond the upper to form a wedge to permit it to be driven beneath a bent rim edge.

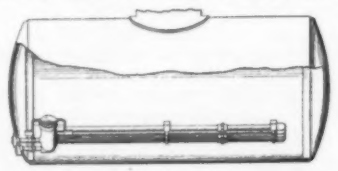
JACK.—H. I. BENEDICT, 250 W. 55th St., New York, N. Y. A specific object of the invention is the provision of a jack in which the lifting element may be easily and quickly set to any desired position and then operated by a crank means for lifting the load, the lifting element being in the form of a rack with which meshes a worm wheel that is adapted to mesh with an operating worm, the worm wheel being shiftable into and out of engagement, so that the lifting element can be readily adjusted to any desired position.

INSERTIBLE SAW TOOTH.—A. M. CURRIER, 315 E. 3rd St., Aberdeen, Wash. The invention relates to a saw tooth adapted for circular saws, band saws, or shingle saws; its general object is to provide an insertible tooth and a holder therefor so formed and arranged relatively to each other and to the saw that the thrust exerted on the tooth when in operation is essentially absorbed by the blade, the holder is substantially relieved of the pressure on the tooth in sawing.

LINE CUTTING TOOL.—G. L. NICHOLS, Ravenswood, W. Va. The purpose of this invention is to provide a line cutting tool having cutting means which is operable automatically to cut a drill controlling line when the tool engages the drill, such means being normally inactive to prevent the accidental cutting of the line during manipulation of the tool to and from the drill.

Heating and Lighting

HEATER FOR OIL TANKS.—G. C. BOWEN, 901 W. 3rd St., Coffeyville, Kan. The invention has for its object to provide a simple, inexpensive, yet efficient device for heating oil tanks, consisting of a series of pipe sections connected with a heater, which will effectually



A SIDE VIEW OF THE DEVICE WITH PARTS BROKEN AWAY

and uniformly heat the oil and prevent freezing, and wherein the coils of pipe are rigidly supported, and wherein the heater will not interfere with the proper scrubbing of the tank.

GRATE.—T. PEARSON, 634 Midland Ave., Syracuse, N. Y. The object of the invention is to provide a grate arranged to permit of conveniently and quickly agitating burning fuel with a view to keep the same free from ashes and to insure complete combustion. Another object is to permit of readily crushing any clinkers without violently disturbing the burning fuel. Another object is to permit convenient dumping of the burning fuel whenever it is desired to do so.

HEATING FURNACE.—A. H. PARKER, 33 William St., Montclair, N. J. The invention relates to a heating furnace in which gas is employed for the fuel. A specific object is the proviso of a heating furnace which embodies a plurality of heating units independently controlled which are supplied from a common cold air box and which have individual hot air ducts leading to different parts of the building, so that heating of the various rooms or floors can be regulated as required.

AUXILIARY STOVE LID.—E. S. GREEN, 36 Lafayette Ave., Trenton, N. J. An object of the invention is to provide an attachment for cook stoves and more particularly relates to an elongated lid adapted to be temporarily placed on the stove over the fire box, when the temporary lids and cross plate are removed, said auxiliary lid having means whereby it may be adjusted to variously position the hole either at the center or at either end of the fire box according to where the hot area in the fire box may be located.

Machines and Mechanical Devices

CENTRIFUGAL CASTING MACHINE.—P. L. GILL, 1133 Broadway, N. Y. The object of this invention is to provide a centrifugal casting machine especially designed for casting annular or cylindrical articles of considerable length and arranged to insure a quick delivery into and a proper distribution of the molten metal within the casting box to prevent undue chilling of the metal and the formation of flaws. Another object is to permit of making castings in which the cross sectional area is equal to or greater than the area of the inside diameter of the casting.

AUTOMATIC FEEDER.—M. POETZSCH, 72 Grove St., Passaic, N. J. The invention relates particularly to an automatic feeder for various kinds of machines as for instance drying, tentering, selvage neutralizing and carbonizing machines. The object is to provide a feed which will cause an automatic adjustment of the various parts whereby the cloth as it enters the machine will properly engage the pins or other engaging members so that the cloth will be stretched, dried and otherwise operated upon without any action on the part of an operator.

CIRCUIT-CLOSING DEVICE FOR LIQUID-LEVEL GAGES.—L. G. LE COMPTE, 2824 25th Ave., Oakland, Cal. In general this invention relates to liquid level gages, but more particularly to that portion directly actuated by the level of fluids, for completing a circuit upon either the rise or fall of the fluid in order to in turn actuate devices at a distant point whereby to register such rise and fall.

Musical Devices

SOUND RECORD.—J. ROBSON, 39 Main St., Moose Jaw, Saskatchewan, Can. The invention relates to phonographs and similar sound reproducing machines using records having sound grooves for engaging with the stylus of the sound box. The object is to provide a covering for such records arranged to protect the records against dust, injurious deposits and other extraneous matter, and to permit using the record in the machine without requiring removal of the covering. Another object is to return the tone arm and the stylus to starting position without requiring stopping of the phonograph.

Prime Movers and Their Accessories

INTERNAL COMBUSTION ENGINE.—P. A. LAWRENCE, 421 E. 8th St., Benson, Neb. The object of the invention is to provide an engine which utilizes the principle of injection of oil under high pressure against air under high pressure, the air being provided by the engine itself during part of its compression stroke. The invention also contemplates the use of an auxiliary air tank supplied with compressed air by the engine during the period when the engine is being stopped.

Designs

DESIGN FOR A PLATE AND THE LIKE.—S. and J. BUTT, 982 Union Ave., Bronx, New York, N. Y.

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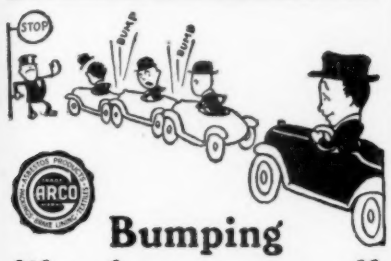

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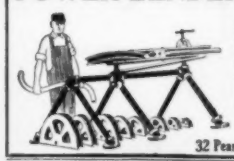

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cesses and machinery which give this country the name of being the most inventive of them all. The question may well be asked whether this country is not as much in need of a Department of Invention as its existing departments are in need of a housecleaning directed against red tape?

The Exploring Rocket

(Continued from page 161)

rocket continues to get impulse from its exploding charge even in complete vacuo. He has made repeated and careful experiments to demonstrate this, and it stands demonstrated. Accordingly the impression which existed in some quarters that his rocket would fail as soon as it reached an atmosphere sufficiently rare is an erroneous one. It does not get reaction from the air, but from its own mass.

In conformance with the purposes which impelled him to make this investigation, Dr. Goddard has so designed his rocket that it can carry a camera or some other instrument of observation and record, together with a gyroscope to keep this instrument properly oriented, if this be necessary. In the SCIENTIFIC AMERICAN MONTHLY for February will be found a long article in which Dr. Goddard's experiments are set forth in considerable detail, and a number of his models are illustrated. In the present place we have space only for this brief presentation of the fundamental features of the undertaking. That this will be a successful one, and that by means of the parachute to be attached to his rocket Dr. Goddard, the first time he sends this little messenger aloft, will recover data of much meteorological value, seems hardly open to question. But he will not shoot at the moon—somebody else will have to do that for him.

From Coal Barge To Bunker

Continued from page 163)

of the endless chain is effected by a drum at the top. This, in turn, is driven by gears so related that ten rotations of the driving shaft are required to effect a complete turn of the drum. The gear connections with the crank-shaft of the engine may have any ratio desired. About the time the "Herald" went into service, this ratio was eight to one and resulted in the bucket movement being carried on at the rate of 65 feet per minute. The engine was a small, direct-acting, double-cylinder steam engine, the cylinders having the size of 7 x 10 inches. It seems that but little power is actually required to drive the elevator and hoist the coal.

Some steamships of the London & North-Western Railway have bunkers arranged on the side. Such bunkers may often be served by the elevators by means of chutes arranged transversely on the coal barge. The elevator delivers to the chute and the coal slides down the chute into the bunker. But a different supplementary device will at times be desirable. A specially designed conveyor may be employed to receive coal from the endless chain of buckets and transfer it to the ship's bunker. Such a conveyor is of advantage when the coal is to be delivered through apertures in the vessel's deck. It is provided with a supporting carriage similar to the carriage used with the elevator. It is possible to elevate the conveyor until it attains an angle of 18 degrees with the horizontal or depress it to 30 degrees below the horizontal. Further, it may be revolved through a complete circle and may be shifted lengthwise of the barge.

The "Herald" has a speed of 5 knots (6 miles per hour). The crew required consists of seven men—master, engineer, assistant engineer, fireman, and three deck hands. This crew is sufficient to attend to all matters connected with navigating the barge and operating her handling equipment. The elevators have a capacity of 100 tons each per hour. Thus a barge might be provided with five elevators and have her hourly-discharge ca-

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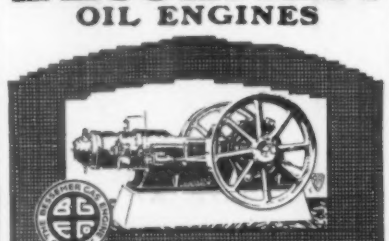

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pacity brought up to the fine total of 500 tons. With a big barge of this description on each side, a liner could take on 1,000 tons per hour. There can be no doubt of the feasibility of the 5-elevator barge, since the elevators work independently of one another. They may operate close together or at wide intervals. This has already been ascertained from the 2-elevator barge.

A notable point in favor of the conveyor system of transfer from barge to liner is the possibility of making it comparatively dustless. With the British apparatus, dependence is, in part, put upon the use of steam to keep down the dust. The drive of the elevator is accomplished, not by an electric motor, but by a steam engine. It is located at the head of the elevator, where it is set between the upper and lower divisions of the chain drive. The exhaust steam is conducted into the elevator head and there directed in such way that it is carried into the chute and finds its way up to the bunker doors. The coal and dust are, accordingly, mixed with this exhaust steam. It appears, moreover, that steam thus mingled has the property of allaying the dust without wetting the coal.

It may be remarked here that such barges as the "Herald" are able not only to coal a steamer, two barges at a time, but that a single barge may coal two vessels at once. The "Herald" has done exactly this.

Referring now particularly to the elevator device employed to dig coal on the "Herald" and hoist it to an elevated position, it may be remarked that the inventors sought to reproduce more or less faithfully the action of a shovel. That this imitation has been pretty successful is indicated, perhaps, by the fact that this type of elevator-conveyor has been put to the job of digging a trench in the soil. The work was successfully done. If the material being handled is wet, the shovel movement is understood to facilitate the complete discharge of the buckets when they reach the head of the elevator.

On board the "Herald," the elevators are provided with trunnions, and these rest in bearings on the carriages, as already explained. But this precise arrangement is not essential. In fact, as this type of digging elevator is adapted to the transfer of materials other than coal and under circumstances of various kinds, a simpler and more adjustable method will be better suited for miscellaneous work. The elevator is adapted for use in discharging a cargo of grain or salt or the like. For this type of service, the construction need not be especially heavy. A crane or a derrick may be used to support the elevators, suitable blocks and tackle being rigged on the crane or derrick, which may be on shore or aboard the ship. The elevator is suspended by its trunnions. The chutes are adjusted and secured to the bolt set at the lower end of the hood. The lower end of the elevator is secured to a rope of a derrick or other hoisting apparatus. This arrangement is useful when the buckets engaged in digging come up against a substantial obstruction—as a block of wood. The lower part of the elevator may then be lifted without disturbing the suspension at the trunnions. If material accumulates at the sides of the lower part of the apparatus, relief may usually be had by lifting this lower part slightly in order to permit the material to flow down and under.

Eliminating the Lost Call

(*Continued from page 164*)

prompt communication with members of the executive staff of a large establishment, no matter where they may be in the plant, instead of playing hide-and-seek in vexatious and protracted efforts to reach them. As one expert has said, considering the problem from the point of view of the steel mill: "If one could compute the loss in production and the increased overhead charges because of such delays, the figures would be unbelievable."

Under the circumstances, it is not hard to realize how audible signals of the character described and similarly controlled could be profitably employed on large construction jobs which are scattered over a considerable area, such, for instance, as skyscrapers in the rearing, water supply and irrigating undertakings, bridges, extensive port improvements, etc. Where the distances are such as to cause a "line drop" in the transmission of operative current, then the needful energy to function the remote horns or other chosen signalling instruments could be drawn from local relays in the form of storage batteries or groups of dry cells, as occasion required.

Professor Karapetoff calls attention to a field of service yet untried, that of effecting communication between ships at a short distance from one another or between a ship and the shore, and vice versa. As he says: "Audible signals should have a distinctly valuable office in covering zones beyond the carrying power of the megaphone and where wireless communication is not available. Signals of this sort could be operated at a much higher speed than through the medium of the inconvenient and comparatively sluggish steam whistle which, moreover, is supposed to be sounded only for navigational purposes." The new locator would lend itself admirably to this end.

Finally, it is urged by this same authority that the ingenious system in question might be used to advantage in balking the efforts of criminals bent upon robbing a bank in broad daylight. By making it possible for the menaced teller to press a button with his foot, and thus to set a locator in motion, warning signals could be made in time to bring to a focus the services of certain men trained and armed to meet such an emergency. The primary problem in such a case is that of preventing the holdup men from getting out of the building and reaching an automobile awaiting their dash with engines throbbing and ready to tear away with the bandits and their loot.

Sugar from the Douglas Fir

(*Continued from page 165*)

not affected. This pointed to the fact that moisture and sunlight and freely circulating air in certain ratio played a part in producing the sugar.

The deposits are from a quarter of an inch to two inches in diameter and occur in considerabel abundance. The Indians of the regions where it occurs have known of it for a long time, and gathered it whenever available, but it was an addition to their food stores that was not reliable, owing to reasons of climate. For the coming of a few cool days in the height of summer would be sufficient to diminish both the activities of the sugar-forming cells and the root pressure and exudation of water, while a wet day, with its cooling of atmosphere and soil, would be still more disastrous to the sugar harvest. But while not a harvest which can be absolutely depended upon, quite a little of it is and was gathered. The sugar has the exceedingly sweet taste of a high quality sugar. For a moment in the mouth it takes on a pasty consistency, but quickly dissolves entirely when acted upon by the saliva.

While the rare sugar from the fir will never take its place in the market as has the cane and sugar beet production, there seems every possibility that further investigation may show it to be highly valuable in chemistry and medicine on account of its rare nature and high percentage of trisaccharide. However that may be, the discovery is of striking interest because of the strangeness of sugar appearing upon a coniferous tree. And in the dry belt when the seasons are good the Indians will probably continue to gather it as their forefathers did before

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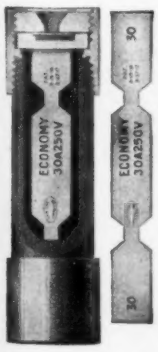

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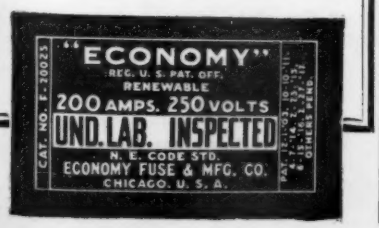

the white man came with his refined grade of sugar gathered from other sources.—*Francis Dickie.*

An Historical Mesquite Tree

(Continued from page 165)

in the heart, is as heavy as and is harder than ash, elm, or white oak, although not so strong or elastic. As fuel it is equal cord to cord to hickory or white oak. It is very durable in the ground and when used for fence posts and foundation posts it will last for many years. The best quality of fuel wood sells for $19.50 per cord in Honolulu and the smaller wood is often made into excellent charcoal.

The high feeding content of the thin yellow beans which this tree produces makes them a very valuable fodder for cattle, horses, and pigs and they usually ripen and fall to the ground at a time when grass feeds are not available. Stock are allowed to pick up the beans from the ground or they may be gathered and stored and fed to the animals after the season is over. The beans are often ground into a meal which makes a well-balanced ration without modification. The protein content of the bean compares favorably with oats and barley and the carbohydrate content, being largely in the form of sugar rather than starch, is attractive to animals, is more easily digested, and far more palatable.

The honey industry of Hawaii is dependent almost entirely on the blossoms of the algaroba tree and the clear honey product is most delicious.

The history of the spread of the algaroba in Hawaii has been as remarkable as the rapid distribution of almost any other known tree. This bountiful tree begins to bear pods when six years old and when these pods are eaten by stock the small horny seeds are not crushed but rather are prepared for quick germination by the action of the digestive fluids. The spread of the tree without the expensive effort of planting by artificial methods over vast areas of barren lands in Hawaii has, therefore, been due almost solely to stock and in this manner it has become a wild forest tree.

The algaroba is often armed with thorny spines, is rarely injured by stock and has few natural enemies. It starts readily on arid, barren ground which is not exposed to the salty ocean breezes, grows very rapidly, and sprouts readily from the stump. Successive cuttings of sprout growth may be made every six years. Contrary to its habit in Texas and elsewhere of sending out a deep root system, the algaroba in Hawaii has a very shallow root system and is subject to windthrow in very heavy storms.

The establishment and perpetuation of an algaroba forest in Hawaii is, therefore, a comparatively simple matter. Here it now holds a distinct place of its own and is a most valuable addition to the island flora.—*C. S. Judd.*

Putting Flax on a Modern Basis

(Continued from page 166)

ponds and rivers. An authority claims the best way of retting is by steeping in water, for the reason that each flax straw contains in itself the germ of bacteria which prey upon the glutinous matter when brought to life, and in favorable surroundings. The object of steeping in water is to bring these bacteria in millions into life and to do this properly it is essential to have water at a certain temperature, which temperature should be maintained as steadily as possible throughout the retting process. To get the best results, it is also necessary to have an ever-constant change of water, as in stagnant water the excrement of the bacteria is apt to stain flax and produce a most offensive effluvia.

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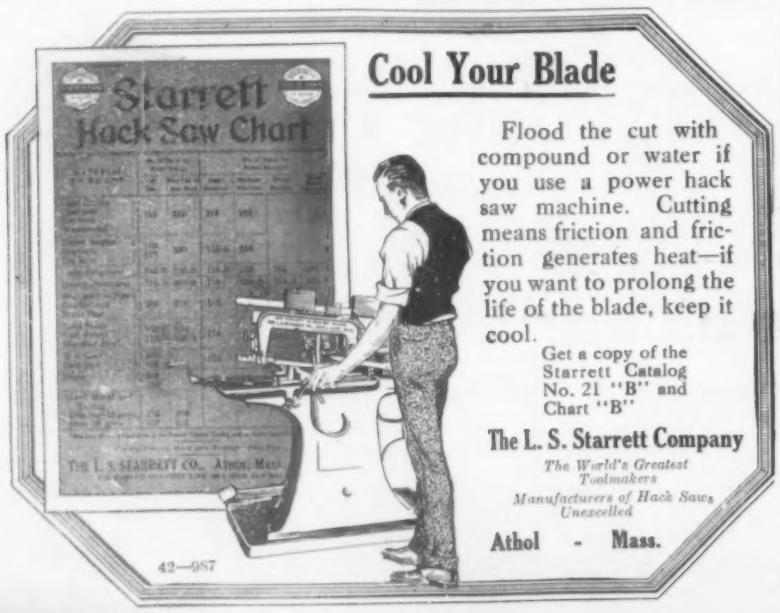

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Detachable and Interchangeable Heels

(Continued from page 168)

tachable and interchangeable heel. His heel, it will be noted in the accompanying drawing, consists of two parts: first, the base, which is permanently attached to the shoe; secondly, the heel proper which locks on the base by a simple means and which can be readily removed and replaced at will.

Imbedded in the inner surface of the heel proper are a number of metal pegs which fit into corresponding slots in the metal plate, forming part of the shoe, as shown. The slots have an upward curve, due to an upward depression of the base at such points. The heel is placed over the plate so that the pegs can engage with the slots, and the heel is struck a sharp blow so as to drive it into alinement with the permanent or upper heel member. This serves to draw up the pegs and consequently the heel until the two surfaces are so tightly held together that no water can penetrate. The heel is finally locked by a sliding key, which is pushed inward locking the central row of pegs into the slots.

A year of constant wear has disclosed this system of detachable and removable heels to be entirely satisfactory. There is nothing to rust—the metal parts being non-corrosive metal—and nothing to stick or jam.

One advantage of this system of detachable heels is that when a heel wears down on one side it can be transferred at once to the other shoe, thus giving double wear. If the ground is wet or slippery, a rubber heel can be immediately replaced by a leather one, or vice versa, according to the desires of the pedestrian. In fact, spiked heels can be applied to the shoes when the walking is exceptionally unfavorable. All in all, the detachable and interchangeable features have obvious advantages.

Convenient as this system may be for men's shoes, it is ever so much more so for women's shoes where high heels have to be contended with. Ladies accustomed to wearing French heels are frequently troubled by the loss of the leather or rubber top lifts of their heels, or are otherwise inconvenienced by the rapid wear of such heels. This inventor has devoted particular attention to this matter of high heels, and has developed top lifts for French heels that are small enough to be carried in Milady's purse. Thus it becomes possible to change the top lifts at any time.

The Double Fovea in Birds of Prey

THAT those birds of prey which fly by day posess a double fovea or sensitive spot in the retina of the eye, was pointed out several years ago. The phenomenon has been recently studied exhaustively by a French scientist, M. A. Rochon-Duvigneaud, who has made a report of the results of his observations to the French Academy of Scientists. He has come to the interesting conclusion that the bird is capable of receiving separate impressions through these foveae. This results in a greater accuracy of impression, just as the tactile perceptions received through two or more fingers are apt to be more accurate than those received through one alone. The birds examined were the sparrow-hawk, the gos-hawk, the common buzzard, the kestrel, and the black kite. The central fovea is situated in front and somewhat above the upper extremity of the "comb," while the lateral fovea is placed above and to the rear of this same extremity.

The central fovea of birds is smaller and deeper than the human fovea. It presents, in fact, almost the same appearance as that of a hole made by a large pin. The lateral fovea is a little bit smaller and not quite so deep as the central fovea.

It is generally assumed that the lateral fovea is utilized for the purpose of binocular vision. The present author contends, however, that in the anatomy of the eye of a bird everything is adapted to the independent vision of each of the eyes. Thus the eyes of a bird are fixed in its head and do not possess the movements of convergence necessary for bringing the image of objects which are receding or advancing to corresponding points upon the two retinas. M. A. Rochon-Duvigneaud concludes that the eyes of birds see independently of each other, just as our two hands touch objects independently of each other. Continuing the comparison he is of opinion that the two foveae are capable of seeing simultaneously and independently precisely as the two fingers of a single hand can receive sensations of touch independently. In other words: "A human being sees almost as with a single eye; he is almost a cyclops. But a bird sees with two eyes separately and independently and each eye of the bird of prey sees with several foveae. Our minds are dominated by the functioning of our own associated binocular vision, so that it is not easy for us to comprehend that two eyes have dissociated and independent simultaneous vision, but if we think of our hands the matter becomes more clear."

Restoring Stained Glass Windows

ACCORDING to information given by M. L. Franchet about the restoration of stained glass windows in France after the damage caused by the war, it is to be remarked that some of these will need to be entirely made over, while others will require more or less repairs. Unfortunately, these repairs are of a very delicate nature, and the author points out that restoration work which has been done hitherto in the old cathedrals or other structures is for the most part improperly carried out. In the first place the panes are usually removed for repairs without taking sufficient precautions to save the intact parts. It is observed that the windows of the Middle Ages were composed of an assemblage of colored glass which make up a veritable mosaic. But it is not as well known that the pieces were cut out of disk-shaped glass plates called *cives*, whose thickness was quite variable in the same plate, for the central part could reach as high as 1.6 in. while the edges had only 0.2 or 0.4 in. These irregularities aided greatly in increasing the effects of light, thus adding greatly to the beauty of the window. Colors were obtained by the use of metallic oxides, but not in the same way as they are employed at present, for they were not introduced in the pure state, but remained mixed or combined with their natural impurities. For this reason the tones of the glass were very different from what are produced by modern industry. There is however no difficulty in producing the glass in *cives* and colored by the old process, and this is not by any means a lost art. It is only by the negligence of the architects that the old form of glass is replaced by flat panes, these being colored in modern crude tones. In this way the appearance of the windows is altogether modified.